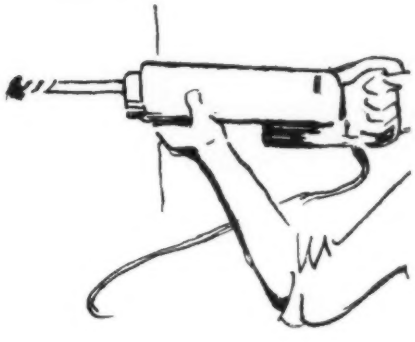
PEST CONTROL

JANUARY 1961

PCO Mail Course STARTS
Lesson No. 1: Entomology
Pg. 9



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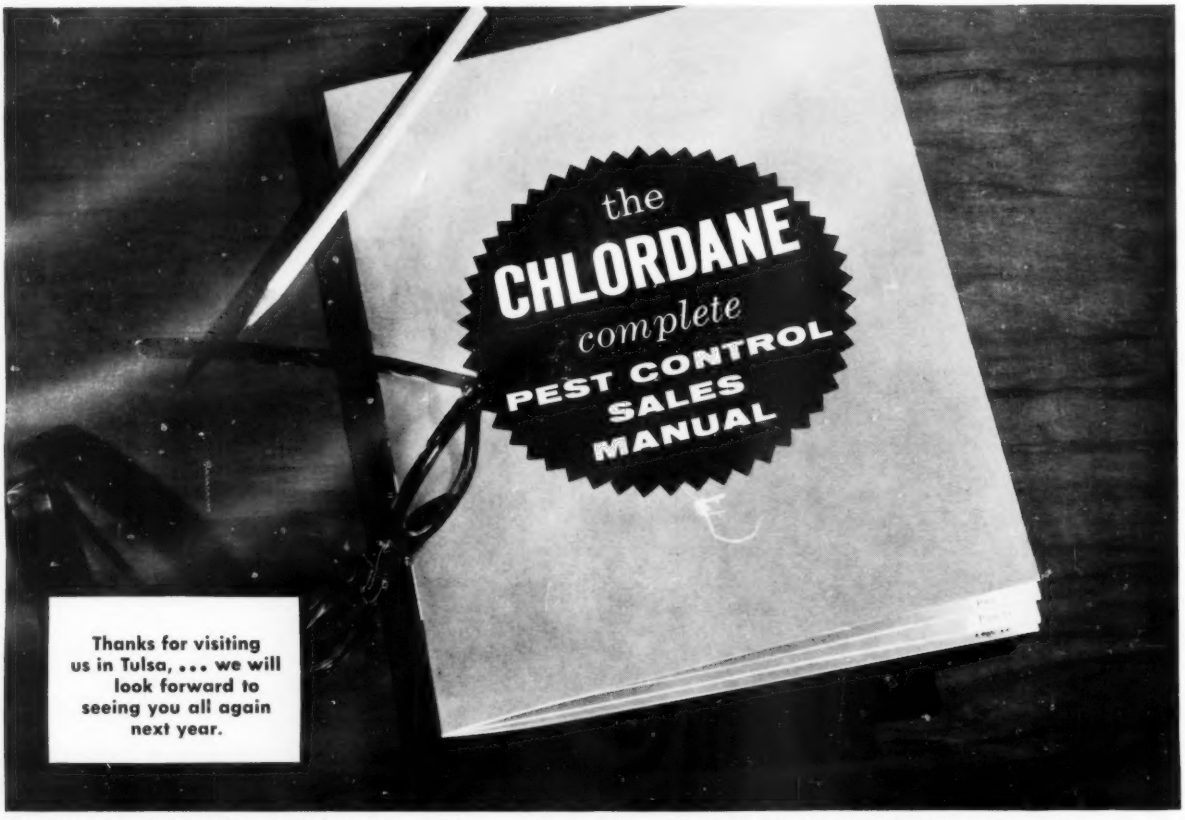

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Backed by Facts

There are many safeguards that restrict the introduction of highly toxic pest control chemicals and limit their use to experienced personnel only. Federal labeling laws require expensive and extensive investigations before new insecticides or rodenticides can be generally marketed. The resultant safety record of pesticide use substantiates the effectiveness of prevailing precautionary methods.

Yet there are great gaps of information on the toxicological effects of both old and new pesticidal chemicals on man. It is important that more detailed experiences be recorded so these gaps can be closed.

The National Pest Control Association will soon be distributing a series of questionnaires to people in the pest control industry. The completed questionnaires will be studied at the U. S. Public Health Service's Communicable Disease Center laboratories in Atlanta, Georgia by Dr. Wayland J. Hayes, Jr., a toxicologist. PCO servicemen and office employees both will be questioned to reflect the relative toxicological effect, if any, between persons continually exposed to pesticides, and those who have little or no exposure to them. It is expected the employees of some 150 to 200 firms will be covered by this fact-finding health survey.

Dr. Hayes, an honorary member of the NPCA who has regularly assisted the association whenever questions of pesticide toxicity to man have come up, will analyze the case history reports developing from this industry study. Answers will be transferred to punch cards to electronically analyze the data from many different aspects. The resultant information will enable Dr. Hayes and others to have a more sound basis upon which to answer the increasing number of claims that exposure to pest control chemicals has impaired the health of customers or servicemen.

This is an excellent example of the highest type of industry and government cooperation to develop information of tremendous significance.

Letters

No Yellow Fever in China

I refer to a guest editorial in your October 1960 issue of *Pest Control* (pg. 61). It quotes Dr. Kirk T. Mosley, Public Health Commissioner of Oklahoma, as saying to a group of PCOs, "While I was in China, one of you could have done more than 10 medical doctors to control yellow fever."

As you know so well there has never been yellow fever reported in China, and I hope there will never be.

Dr. Luis Vargas

Intituto de Salubridad Y
Enfermedades Tropicales
Mexico City, Mexico

After receiving Dr. Vargas' letter, Pest Control *checked with the Cleveland Academy of Medicine and found Dr. Vargas was correct. However, since the guest editorial quoted Dr. Mosely who allegedly made the statement, we wrote him to straighten the records. Dr. Mosley sent the letter that follows.* Ed.

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Nowhere in Asia

I speak very rapidly and in my talk before Oklahoma PCOs I listed, at a fast rate, a great number of common vectors of disease and their geographic distribution. I did not use a manuscript, but spoke from notes. Thus I can understand how this error was made.

I do regret this obvious error appeared in print. It is common knowledge, and one of the curious features of yellow fever, that it is restricted to the African, South American, and Middle American areas except on few occasions when it has extended beyond this boundary. As far as I know, yellow fever has never been found in the main part of the Asian continent and certainly has never been reported in China.

Kirk T. Mosely, M.D.

Oklahoma Department of Health
Oklahoma City, Okla.

Baseball Makes a "Hit"

I read with interest your portrait article of J. C. Redd's Pest Control Co. and his interest in Little League baseball. (Nov. 1960, pg. 9).

When Little League started in Levittown, Pa., I had not only a personal interest but also a desire to teach young boys how to play the game. In 1954 I was manager of a minor American Little League team. In 1955 I was coach for a major Little League team and the following year, vice president of the League and coach for a team of older boys. In 1958 I managed the Levittown champs.

I have found Little League baseball to be a great community builder and a wonderful source of recreation for boys. I will always stop to pause with great respect for others who sponsor or work with their communities in this recreation. Please shake Mr. Redd's hand for me.

Charles N. Barnett

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Pest Control welcomes expressions of opinions from its readers. Send ideas and comments as briefly as possible to James A. Nelson, Editor, Pest Control, 1900 Euclid Avenue, Cleveland 15, Ohio.

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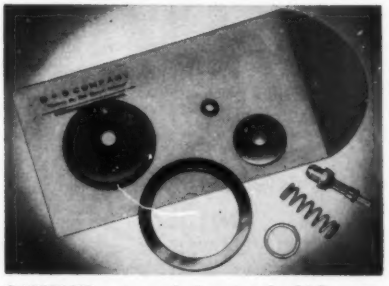

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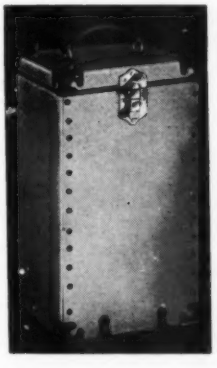

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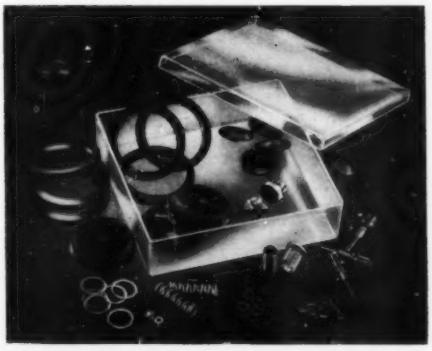

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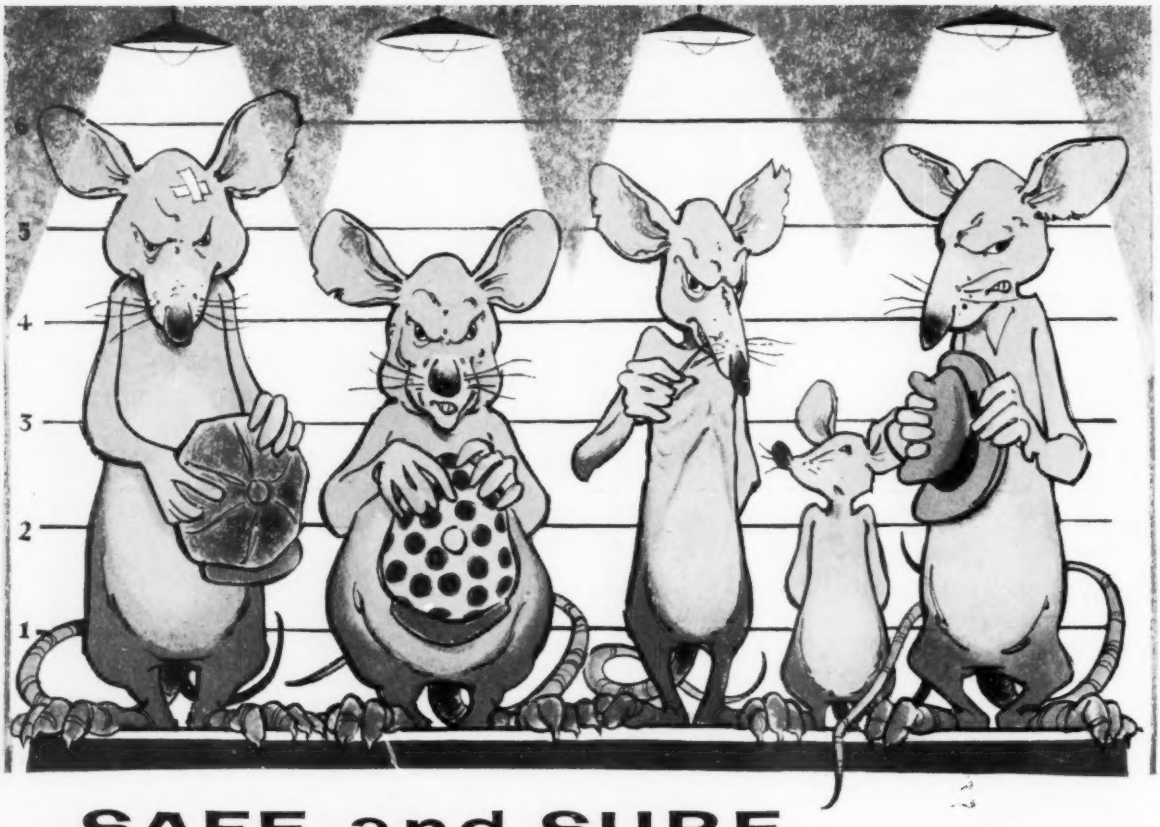

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A Correspondence Course In Pest Control Technology

By LEE C. TRUMAN, Ph. D.*

*Correspondence Course Editorial Committee: Dr. John V. Osmun, Dr. Howard O. Deay, William L. Butts, Dr. Philip J. Spear, Dr. Harry D. Pratt, George L. Hockenyos, and James A. Nelson

INTRODUCTION

Your ability to offer good pest control service is bounded by the horizon of your experience. You can push back your horizons — broaden them — in many ways. On-the-job experience is one way, but this road is paved with mistakes and it is often a dead end. A working knowledge of the technical and business aspects of pest control can be achieved only by study. A knowledge of the science undergirding the pest control industry: recognition of the pests to be controlled, an understanding of their habits, the relationship between chemicals and pests, a knowledge of control measures and the methods of application — all are foundation stones of successful pest control. Combine them with a personal awareness of the need for good relationships between pest control operator and customer, and you have the total foundation upon which sound business practices can be built.

This correspondence course in pest control technology is designed to provide a basis for such knowledge. It is written for owners, supervisors, servicemen, and salesmen. Each lesson covers material considered essential to the proper understanding of pest control. In addition to the lessons printed in *Pest Control* magazine, supplementary reading is suggested at the end of each chapter for those desiring to study in more detail.

Here is how the course works. Like any student taking a course through a university, you must register with Purdue University and pay your fee. The fact that the chapters will be printed in *Pest Control* magazine for your convenience and encouragement is only part of the story. The University will provide a comprehensive series of work sheets and questions which will be mailed to the student each month. After you have completed your lesson and perhaps posed some of your own questions, you will mail the sheets back to Purdue where the material will be graded and commented upon by a member of the entomology pest control staff. This procedure will give the registered student correct information for his reference and will permit him to have a better understanding of anything about which he may have been in doubt. Upon satisfactory completion of the course, the University will provide a Certificate of Completion with the student's name inscribed thereon as evidence of the student's participation.

Face this course with your mind open and with a determination to see it to a successful conclusion. The value of it will be measured by what you do with it, and not what it does for you. It simply provides you with an opportunity to learn and thus improve your personal value to yourself and to your employer. The pest control industry, more than many other occupations, is intimately based on a science. This means that technical terms will be used to permit a common ground for understanding both of what you study in these lessons and of what you read elsewhere. It means that much information will be present, which on the surface seems relatively unimportant as part of business practices, but which will ease the path of learning for the practical aspects of the course to follow. Work especially hard on lessons 1 and 2; the effort will pay dividends later on. This study course is intended for the serious student rather than the casual reader, and for such a person, the scientific approach is very understandable and provides the only sound way to appreciate the full scope of pest control activity.

This is a good time to do a few things in addition to the direct requirements of the course. For example, it is an ideal time to make an individual reference insect collection. Your first University mailing will include a pamphlet explaining the value and the method of doing it. This is also an excellent opportunity to collect examples of pesticides in their different formulations.

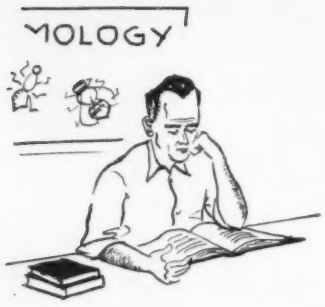
This course was written for all of you associated with the pest control industry. It is important that you complete all of the lessons; even these are but the beginning of a full understanding of the scope of activities in the industry. Not only is technical background essential for correct control procedures, but it is the very essence of good sales approaches and public relations. The author, Doctor Lee C. Truman, in preparing each lesson has drawn on a wealth of experience — experience gained by utilizing technical know-how in business. In turn, the editorial committee, comprised of specialists in entomology, pest control technology, business, teaching, and writing, have reviewed the material with the industry members in mind. The course is the editorial judgment of all of them. Their experience should now be yours.

We asked Doctor Truman, who at one time had the material to learn for himself, what advice he would give a student entering the course. His reply was to the point:

> "Study carefully, study long, allow yourself time for the information to become a part of your thinking, and put it to work for you every day. The course will return to you in knowledge and better service as much as you put into it in time and effort."

Be sure that the Certificate of Completion someday hangs on the wall of your business office. An increasing number of customers will like to see it.

John V. Osmun, Head
Department of Entomology
Purdue University



Lesson No. 1
Entomology

THE INSECTS you controlled today are just a minute fraction of the millions which inhabit the world. Man does well to hold his own in the face of the constant pressures that insects continue to exert upon him. Not only are the total numbers tremendous, but the number of individual kinds, or species, certainly exceed 800,000 — a number greater than that of all other animals combined. Many of these are beneficial but some are especially competitive with man. Not only are insects numerous, but they are among the most adaptable of all animals. In their many forms, they are fitted for almost any specific way of life. Their adaptability, combined with their tremendous rate of reproduction, gives insects an unequaled potential for survival!

Insects vary in size from as small as 1/100 of an inch to as large as 6 to 10 inches long. The food of insects includes almost anything that can be eaten by any other animal as well as many things which cannot even be digested by any other animals. Insects live in the darkest of surroundings as well as in bright sunlight and in areas of ice and snow as well as in exceedingly hot locations.

Most insects do not harm the products of man nor carry diseases harmful to him; however many do carry diseases and others feed on his food and manufactured goods. Some are adapted to living only in open areas while others are able to live in extremely confined spaces. All of these factors combined make the insects a group of animals having many members which are a nuisance to man and thus of great importance to the pest control operator.

The control of insects requires an understanding of their way of life. Thus it is necessary for the student of pest control to understand the anatomy of the insect, its method of growth, the time it takes for the insect to grow from egg to adult, its habits, the stage of its life history in which it causes damage, its food, and its common living places. In order to obtain the best control it is especially important to be able to identify correctly the specific insect involved because without this knowledge, it is impossible to prescribe a proper treatment.

Any field of study involves the use of a vocabulary which is especially adapted to it. The technical words used in the study of insects and their relatives are no more difficult than those used in any other field and are necessary so that two people talking about an insect or group of insects will be certain that they are talking about the same thing. Almost everyone is familiar with the words "carburetor," "chrysanthemum," "polyethylene," "pyrethrum," "penicillin," "virus," and "cauliflower." These are all technical words and are derived from Latin or Greek words just as are most of the special terms used in entomology. The specific words used in the study of entomology are no more difficult to remember than these and, once you have become familiar with them, they will also become a part of your regular vocabulary. An understanding of these words is necessary so that you will be able to understand the writing in any of the books listed as references in this course.

INSECT ANATOMY

The insect body is generally a more or less elongated tube with appendages, such as legs, wings, or antennae, on either side so that each side is like the other. This arrangement is referred to as bilateral symmetry. The body is segmented or jointed, as shown in Figure 1-A, with segments being grouped into three distinct regions: the head, thorax, and abdomen.

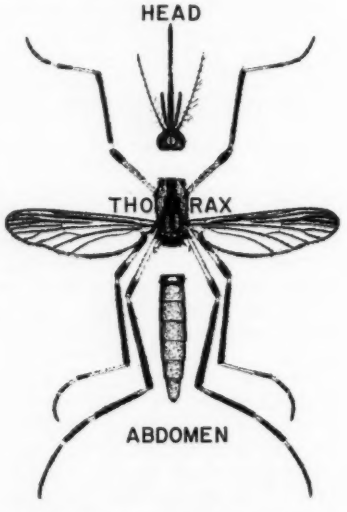


Figure 1-A. Drawing of a female mosquito showing the three principal regions of an insect's body. (Adapted from Carpenter and LaCasse, "Mosquitoes of North America," by permission of The University of California Press.)

In adult insects the eyes, antennae, and mouthparts are on the head. Legs and wings are attached to the thorax. The appendages on the abdomen, when any are present, are usually on the last segment only. Abdominal appendages are usually sex organs, or hairs, or bristle-like extensions known as cerci. Most appendages on the insect body are segmented.

The skeleton of the insect body is on the outside, rather than on the inside as with man and other mammals, thus serving not only as an outer covering of the body but also as the firm portion of the body to which muscles are attached. Such muscle attachment makes it possible for an insect to have overall strength out of all proportion to its size.

The body wall is composed of two principal layers, a cellular epidermis, or outer skin, and a non-living cuticle. The cells of the epidermis produce a hard outer layer called the cuticle and, in addition, certain specialized cells produce surface hairs and glandular secretions which are found on the surface of the insect body.

The cuticle itself is made up of three principal layers.

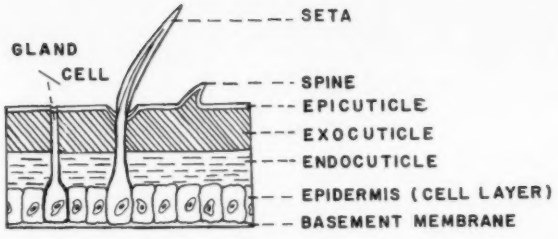


Figure 1-B. Drawing of a section through the body wall of an insect showing the principal parts.

The endocuticle and the exocuticle, Figure 1-B, contain the materials chitin and sclerotin which are typical of the insect skeleton and contain any coloring matter which may be present. The epicuticle is a very thin, waxy layer which protects the insect body so that moisture does not evaporate from it. This layer is important to the pest control operator because insecticides which work through the body wall must be able to penetrate, or dry up this layer in order to be effective.

The body wall completely covers the insect. In some portions, it is hardened to form plates or sclerites; in others it is soft and flexible forming membranous sutures, or joints, between the sclerites. This body wall is always in one piece with hard and soft portions being merely variations in the same structure. For example, the usual insect abdomen is quite firm because of its segmented rings, or sclerites, which extend around it; it is also flexible and expandable because of the flexible sutures which connect these sclerites to each other and which join the parts of each sclerite to the other parts.

HEAD

The typical insect head is a hollow capsule made up of a number of segments which have been solidly fused together and which cannot easily be distinguished. The head is usually quite hard.

Sense Organs

The antennae are appendages of the head, and they are nearly always made of many segments. The shape, number, and relative size of the segments are characteristics frequently used to identify an insect. There are many different general kinds of antennae, a few of which are illustrated in Figure 1-C. Antennae are sense organs having the functions of touch, smell, and in some cases hearing.

Most adult insects have a pair of relatively large compound eyes located on the head. The surface of these eyes is made up of many small lenses, each of which is the lens to a single portion of the compound eye. In addition, most insects also have simple eyes located on the upper part of the head between the compound eyes. Some insects have no simple eyes in the adult stage, but among those that do, the number may be one, two, or three, depending upon the kind of insect.

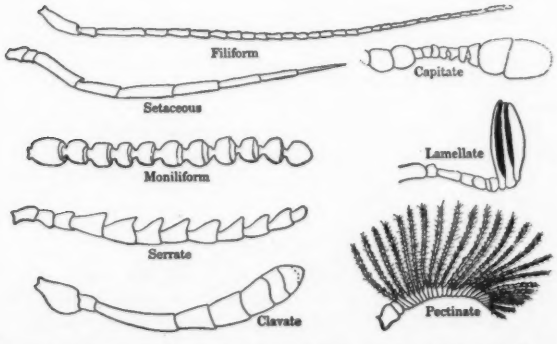


Figure 1-C. Some representative types of antennae found in insects. (From Ross, "A Textbook of Entomology," by permission of John Wiley and Sons, Inc.)

Mouthparts

An insect's mouthparts are made up of extensions of the original head segments and are located, usually, on the bottom of the head although on some insects the head is held so the mouthparts extend forward. Variations in insect mouthparts are characters which are frequently used in the identification of insects. The type of mouthparts also serves to tell something of the food habits of the insect and may well make it possible to tell where to find the insect by looking for a suitable source of food.

Mouthparts of Adults

The structures which make up the mouthparts of insects vary greatly in shape and function. In many insects they are formed for biting off and chewing solid foods, such as leaves, wood, fabrics, or kernels of grain. In others they are formed for piercing the skin of animals or the epidermis of plants and sucking up blood or plant sap from beneath the surface. In still others they are formed so the insect can feed on exposed liquids such as water and nectar.

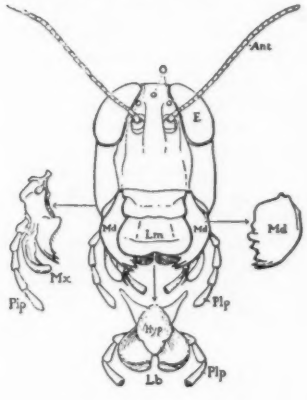


Figure 1-D. Head of grasshopper showing typical chewing mouthparts. *Ant*, antenna; *E*, compound eye; *Hyp*, hypopharynx or tongue; *Lb*, labium or lower lip; *Lm*, labrum or upper lip; *Md*, mandible or upper jaw; *Mx*, maxilla or lower jaw; *O*, simple eyes; *Plp*, palpus. (From Ross, "A Textbook of Entomology," by permission of John Wiley and Sons, Inc.

Based on the form of their food and the method by which they obtain it, the mouthparts of adults may be divided into 6 principal types or kinds: chewing, rasping-sucking, piercing-sucking, sponging, siphoning, and chewing-lapping.

Chewing Type of Mouthparts

This is the most primitive and therefore the most basic type; it is found in insects such as cockroaches, termites, beetles, and chewing lice, which feed on solid food. In this type the mouthparts are made up of 7 well defined structures, most of which are found in insects with other types of mouthparts, but there they are usually greatly modified in form. (See Figure 1-D.)

Structures found in the chewing type of mouthparts are as follows:

Upper Lip (Labrum): This is a simple flap which covers the upper jaws much as our upper lip covers the upper teeth.

Upper Jaws (Mandibles): There are two upper jaws, each of which is a solid structure which has tooth-like projections on the inner side. The jaws move from side to side, or transversely, and are used to tear or bite off the food and chew it.

Tongue (*Hypopharynx*): This is a fleshy organ found inside the mouth.

Lower Jaws (*Maxillae*): There are a pair of these, each of which is made up of several parts. Attached to the outside of each is an antenna-like structure called a maxillary palpus which may contain organs of taste, touch, and smell. The lower jaws move from side to side as do the upper jaws.

Lower Lip (*Labium*): The lower lip is made up of several parts and bears a labial palpus on either side which has the same functions as the maxillary palpi.

Rasping-Sucking Type of Mouthparts

Insects which possess this type of mouthparts lacerate or rasp the epidermis of plants with three needle-like organs, the stylets, until the sap flows out. They then retract these stylets and suck up the exposed sap. The only insects which possess this type of mouthparts are the thrips (Order Thysanoptera).

Piercing-Sucking Type of Mouthparts

In this type, the parts have been modified so that the insect can pierce the skin of animals or the epidermis of plants and suck up the blood or plant sap from beneath the surface.

There are many varieties or sub-types of the piercing-sucking type. In the orders Hemiptera (bugs) and Homoptera (leafhoppers and aphids), the mouthparts are prolonged into a long, tube-like structure called a beak. The outside of the beak is formed by the lower lip. Inside the beak are four long, slender organs called stylets. These stylets are the modified upper and lower jaws. Those corresponding to the upper jaws are used to pierce the tissue and the other two (modified lower jaws) are grooved on the inner sides and interlocked in such a way that they form two ducts. Saliva is pumped into the animal or plant through one of these (the salivary duct) and the blood or the plant sap is sucked up through the other (food channel). Although this is the general arrangement found in the various insects with piercing-sucking mouthparts, there are numerous modifications of it in mosquitoes, biting flies, fleas, and lice. Figure 1-E illustrates the mouthparts of a mosquito.

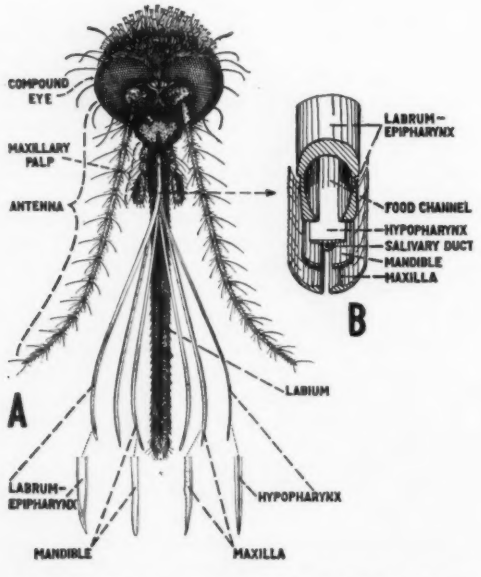


Figure 1-E. Piercing-sucking mouthparts as found in a female mosquito. (A) Front view of head and mouthparts with the stylets spread out and their tips more enlarged below. (B) Diagramatic projection of the stylets and the feeding tube formed by them. Much enlarged. (By permission from "Destructive and Useful Insects," by Metcalf, Flint, and Metcalf, Copyright 1951, McGraw-Hill Book Co., Inc.)

Sponging Type of Mouthparts

Some flies, such as house flies, blow flies and fruit flies, are unable to pierce the skin of animals or the epidermis of plants and, therefore, must feed on exposed liquids. The lower lip, as in other flies, is elongated to form the outer covering of the soft beak within which are two slender structures that form a salivary duct and a food channel. The tip of the lower lip is enlarged into a large sponging organ which has a series of grooves radiating from the center. When the fly dips the end of its beak into liquids, the liquid flows up these grooves until it comes in contact with the food channel. The food is then sucked up through this channel into the esophagus.

Siphoning Type of Mouthparts

In moths and butterflies, a part of each lower jaw is elongated. The parts are interlocked to form a long, slender tube through which exposed liquids, such as nectar and water, are sucked. This tube or "tongue" is coiled up like a watch spring when it is not being used.

Chewing-Lapping Type of Mouthparts

In some bees and wasps the mouthparts are formed both for the chewing of solids and the sucking up of exposed liquids, especially nectar. The upper lip and the upper jaws are of the same form as they are in the chewing type of mouthparts. The lower jaws and the lower lip are elongated to form a "tongue" with which the insect can suck or lap up liquids.

Mouthparts of Immature Insects

In insects which develop without metamorphosis or with gradual or incomplete metamorphosis, their immature forms (young, nymphs, naiads) have the same type of mouthparts as their parents. That is, if the adult has piercing-sucking mouthparts, the nymphs will also have piercing-sucking mouthparts.

Larvae, the growing stage of insects with complete metamorphosis, may or may not have the same kind of mouthparts as their parents. The larvae of Coleoptera (beetles), Lepidoptera (moths and butterflies), and the leaf-feeding Hymenoptera have typical chewing mouthparts although the various parts may be reduced. The larvae of fleas and a great many of the more primitive flies, like mosquitoes, deer flies, and black flies, also have chewing mouthparts which are not as well developed as in the above insects.

In the larvae of the higher Diptera, such as house flies, blow flies, and fruit flies, the head is greatly reduced and withdrawn into the thorax. The food has to be in liquid form. Although the immature stages of some flies have no true jaws, there are usually two mouth hooks present which enable the larvae to lacerate tissue.

Mouthparts of the larvae of bees, ants, and wasps are much reduced. In general they are of the chewing type. However, the larvae of many of the ants and bees are fed liquids.

THORAX

The middle region of an insect body is known as the thorax. It is made up of three segments to which the legs and wings are attached whenever they are present. The segments of the thorax are usually quite hard and are frequently fused solidly together to provide a firm base for the many muscles necessary to operate the

wings and the legs. On either side of the thorax there are two small, slit-like openings called spiracles which are external openings to the respiratory system. The thorax is connected to the head by a membranous neck region called the cervix.

Legs

An insect leg is always jointed and consists of 6 parts: coxa, trochanter, femur, tibia, tarsus, and pretarsus.

The coxa and trochanter are the two parts which connect the insect leg to the body with the trochanter being between the coxa and the femur. The femur corresponds more or less to the thigh of man, and the tibia to man's lower leg. The tarsus is composed of several joints and corresponds to the foot. The last tarsal segment usually bears a pair of claws and frequently pads or lobes between the claws. These claws and pads together form the pretarsus.

Variations in the size and shape of the leg segments are characteristics which can tell a pest control operator a great many things. The legs are modified for running, jumping, grasping, digging, and in many other ways that give a good insight into the habits of the insect. Typical running and jumping legs are pictured in Figure 1-F. Variations in the leg are also much used in identification.

Wings

Insect wings are an outgrowth of the body wall on the last two segments of the thorax. Most adult insects have two pairs of wings but some have only one pair and a few have none. Most insect wings consist of a thin membrane; in some insects, however, the front pair of wings are thickened and leathery or hard. The variation in the number of wings, their size, shape, texture, arrangement of veins, and the position in which they are held at rest, are also characteristics used for identification.

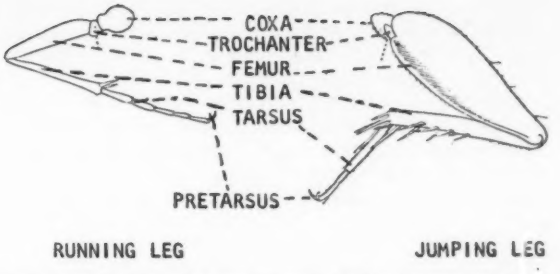


Figure 1-F. Two types of leg structure commonly found in insects. (Adapted by permission from "Entomology," by Folsom and Wardle, Copyright 1934, McGraw-Hill Book Co., Inc.)

ABDOMEN

The insect abdomen is composed of 11 segments although the last segment is usually so reduced in size, or so modified, that only 10 segments are easily visible. In some insects several segments may be fused together so that there appear to be less than 10. There is a small hole-like opening on either side of each of the first 7 or 8 abdominal segments when 10 are present. These are the spiracles which open into the internal respiratory system. There are various appendages which may appear on the last segment of the abdomen. Of these appendages, the most noticeable on many insects are the cerci which extend from the last abdominal segment. Genital appendages may be lacking but, when present, the most conspicuous organs are the claspers of the male and ovipositor of the female. These genital organs may be present externally or may be totally enclosed within the abdomen so that they are not visible.

This difference in the apparent number of segments in the abdomen, together with the variations in the appendages on the last abdominal segment, are characteristics frequently used in identification.

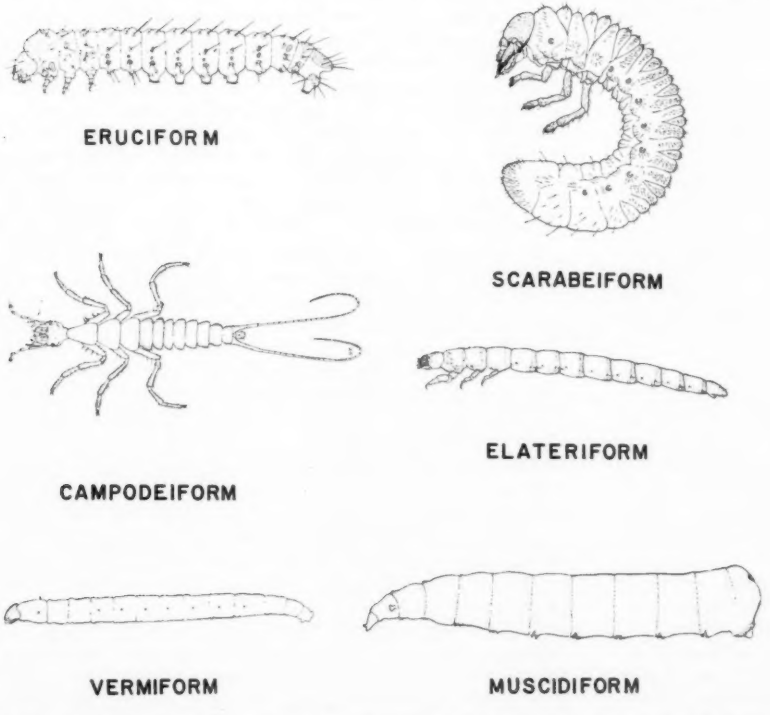


Figure 1-G. Some typical body forms of insect larvae. (From Peterson, "Larvae of Insects, Parts I and II," by permission of the author.)

LARVAE

One of the most striking features of the study of insects having complete metamorphosis is the great variation in the appearance of the larval forms. Many insect larvae resemble their parents so little that it is only through detailed life history studies that the true relationships have been learned.

There are many different types of insect larvae, some of which are very rarely seen except by specialists who are engaged in the study of them. There are, however, certain forms (see Figure 1-G) which are rather commonly found and of which the pest control operator should have some knowledge.

One of the most commonly encountered forms of larvae is that which is known to practically everyone as the caterpillar. Its body is generally long and cylindrical in shape. There is a well-defined head followed by a three-segmented thorax which bears the true legs. The abdomen also bears fleshy outgrowths on the underside of some of the segments. Although these structures are used by the larva in

much the same way as the true legs, they are quite unlike the true legs in structure and are known as prolegs. This type of larva, which is often called the eruciform type in technical writing, is found in most Lepidoptera (moths and butterflies) and Mecoptera (scorpion flies) and in some Hymenoptera (sawflies).

A second commonly found larval type is one which is often called a "grub." This type of larva is found mostly among members of the order Coleoptera (the beetles). It has a well developed head followed by a three-segmented thorax which bears the true legs. There are no prolegs or other appendages on the abdomen and the entire abdomen curves gently downward and forward so that when viewed from the side the outline of the body resembles the letter "C". This type of larva, known technically as a scarabeiform larva, generally has a rather stout, fleshy body with a whitish unmarked body wall. Many beetle larvae have the well developed head followed by a thorax and abdomen which are rather long and somewhat flattened in shape. There are no prolegs and the true legs on the thorax are rather long in proportion to the body and are usually rather well adapted to running. The antennae are long, and there are two cerci at the tip of the abdomen which may be as long as the antennae. This type of larva is also found in the orders Neuroptera (lace-wings) and Trichoptera (caddisflies). It is known in technical writing as a campodeiform larva.

Another distinctive larval form found among the beetles is the long, narrow, cylindrical type often called "the wire worm." The body wall is usually quite hard, and the true legs (there are no prolegs) are quite short in relation to the body. The term elateriform is usually applied to such larvae in technical literature.

There are a great many larvae which have rather long, narrow, cylindrical bodies, and on which there are no legs, both the true legs and prolegs being absent. In some of these larvae there is a distinct head, but in others there is no well developed head. The technical term covering this broad grouping in scientific writing is "vermiform larva." The literal meaning of this term is "worm-like larva." Such larvae are commonly found in the orders Diptera (flies and mosquitoes), Siphonaptera (fleas) and in some Lepidoptera and Coleoptera. While the type in which the head is not well developed may be called "worm-like" or "maggot-like," many authors of technical material use another term, "muscidiform" to refer to it more specifically. This form is found only in the order Diptera.

This short discussion has covered six of the more commonly encountered larval types, but it must be remembered that many other types exist, some of which exhibit a rather strange and bizarre appearance.

INTERNAL ANATOMY

An insect's digestive tract is a tube which runs the full length of its body and consists of various parts and glands to make it possible for the insect to digest its food. These various parts are modified according to the type of food the insect eats. Insects, such as flies and cockroaches which require much moisture in their diet will usually excrete a moist waste material. Others, such as dry wood termites and the various grain insects, will excrete a dry pellet. There are numerous glands of the digestive tract in all insects; among these are those which are situated in the region of the head and which usually secrete saliva. In blood-sucking insects, these glands produce a material which keeps the blood from coagulating while the insect is feeding; while in the larvae of Hymenoptera (bees, wasps, ants) and Lepidoptera (moths and butterflies), certain of these glands secrete the silk which is used in making larval nests and cocoons.

The circulatory system of an insect does not consist of a series of blood vessels as it does in man. Insect blood is pumped by an open-end tube located along the back and running the entire length of the body. This tube picks up blood from the back portions of the body and pumps it into the head from where it simply flows back around the body parts to the rear where it is picked up and pumped again.

Insect blood performs several principal functions. Food materials are absorbed from the digestive system and carried to the body tissues. Waste products are picked up and carried to the excretory organs in order to be discharged from the body. The blood may also have dissolved in it a small amount of oxygen which it carries to the body tissue. This function, however, is not a principal one of the blood as it is in warm-blooded animals. Certain cells in the blood dispose of bacteria and other organisms which might be harmful and also assist in the healing of wounds. The blood system of insects is also used to maintain or change the pressure inside the body. This pressure can be changed by contractions and expansions of the external skeleton. Localized pressure is used to expand the size of the body after molting and to inflate the wings.

Insects have essentially the same nutritional requirements as does man, including fats, carbohydrates, proteins, vitamins and minerals. At some stage in the insect's development, it obtains a balanced diet. The German cockroach for example obtains its nutrients from a wide variety of foods. Mosquitoes, which as adults may feed only on blood, obtain other nutrients in the larval stage. Termites, which feed principally on wood or other cellulose-bearing materials, are aided by micro-organisms in their gut and the presence of fungi in the wood and soil. The required diet is therefore frequently completely different in the immature stage from that of the adult of the same species. Regardless of all other food requirements, all insects require a regular supply of water. Those which live in situations where a supply of water is readily available will drink it while many insects, such as grain beetles, which live in relatively dry materials have developed a system of conserving and converting to body use the little bit of moisture that is actually present in their food supply.

A knowledge of the food requirements of any given insect is most important to the pest control operator. Such knowledge will aid him in locating an insect in a given situation. Thus one usually looks for confused flour beetles only in dry cereal products, carpet beetle larvae on woolen or hair products, termites in wood, lice on animals, or German cockroaches generally near the kitchen or a drain where their particular type of food may be obtained.

The respiratory system of an insect is made up of a series of tubes, called tracheae, which extend into the body cavity. These tracheae divide into smaller, tiny tubes called tracheoles, which carry oxygen directly to the tissues of the insect body. Tracheae open to the outside of the body through openings known as spiracles usually located on the sides of the thorax and the abdomen. The number of spiracles varies in different groups of insects and varies from larvae to adults. In some larvae, which live in water, there are no spiracles. In these forms, the spiracles are replaced by fine tracheae which run into gills or close under the skin where oxygen is taken up directly from the water

in which the larva lives. Many insects can draw air into the tracheae and can expell air by expanding and contracting their body wall. Some can also open and close the spiracles to avoid drawing any harmful materials into the tracheae.

The respiratory system is important to the pest control operator because of the fact that some dry dusts, which are otherwise non-toxic, can clog up the openings at the spiracles and thus deprive the insect of the oxygen which is necessary for it to live. Many insecticides, particularly those used as fumigants, are also actually diffused into the insect body through the spiracles thus permitting internal penetration through the tracheae and tracheoles.

The nervous system of insects is highly developed. As in other animals, it coordinates the activity of the insect in relation to its environment. There is a brain, located in the head, and pairs of nerve centers called ganglia. These nerve centers and the brain are connected by a nerve cord. The ganglia and the nerve cord, other than the brain, are located on the bottom side of the insect body. Nerve endings are particularly concentrated in such places as the mouthparts, antennae, and in the tarsus. Certain insecticides sprayed or dusted almost anywhere on the body will penetrate the body wall and reach some of these nerve endings. Of particular interest to the pest control operator is the fact that an insecticide applied to surfaces on which insects may walk is taken into the insect through the tarsi of the legs, and from there finds its way to sensitive and susceptible nerves where poisoning may take place.

The muscular system in the insect body is quite complex. Some insects have more than 2,000 muscles. These muscles are arranged internally in such a way that a very efficient system results, permitting unusual total strength for the size of the animal; many insects can lift weights as much as 20 times their own body weight. Such small insects as a flea can jump as far as 5 or 6 inches. Segments of the body are connected by muscle bands which maintain the body form and which make possible the many movements noted in insects.

In most insects there are two sexes, male and female. There are a few insects, however, in which both male and female sex organs are present in one individual. The portions of the sex organs important to the pest control operator are the external organs located at the tip of the abdomen. The variation in these organs makes it possible to differentiate not only between males and females of the same species but also, in many instances, between one group of insects and another.

INSECT BEHAVIOR

Insects respond to various situations in a largely automatic manner. There is no particular thinking or intelligence involved in their reactions. The nerve pathways involved in insect behavior are largely inherited and each insect will usually react as do others of the same kind. Many of an insect's reactions are toward or away from a stimulation, such as light, temperature, moisture, chemicals, touch or contact, the force of gravity, or currents of air or water. Many moths fly toward light while bedbugs avoid it. Some insects locate their food by a response to a chemical odor while certain chemicals repel insects. Although insects will usually move away when touched or squeezed, the cockroach will force itself into a small opening. House flies generally move upward to rest at night but do not exhibit this response during the day.

Most insects lay their eggs in a certain way and in certain places; they feed in a characteristic place and manner, live in a given type of environment, and move about from place to place in a typical way and by a typical route.

There is good reason why the pest control operator should understand the typical responses of each insect that he is trying to control since a knowledge of such responses will enable him to locate the insect and to place his chemicals so as to achieve the most effective control. Furthermore, such information will better enable him to explain to a customer both the cause of infestation and reasons for the controls which he prescribes.

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2. Insect Development and Classification
3. Pesticides
4. Pesticides and Safety
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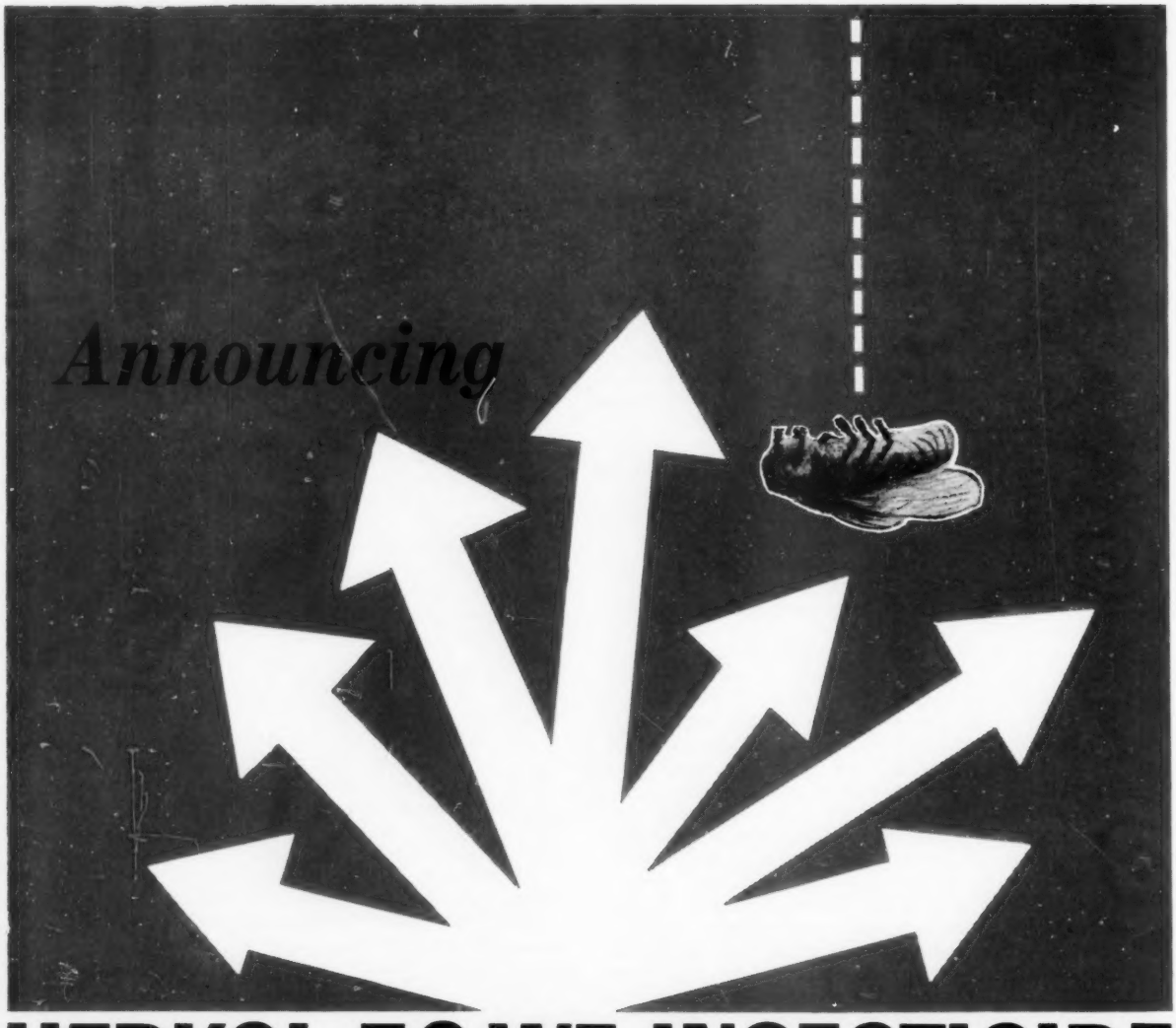

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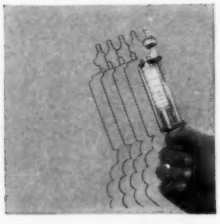

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Pretreat Against Injury

A Safety Program Will Keep Accidents from Infesting Your Business

IRONICALLY, neither the most severe nor the most frequent accidents that occur in pest control work are caused by exposure to or misuse of insecticides. Apparently constant warnings and meticulous training have made servicemen aware of the danger associated with toxic materials and have kept accidents and injuries caused by chemicals to a minimum.

Nevertheless, the pest control industry ranks above the national industrial accident average in frequency of mishaps, according to one of the latest industry surveys. What, then, causes this over-average record?

Six-month accident records of pest control operators who participated in the industry survey revealed that cuts and burns were most frequently mentioned as a cause for lost working hours. Lifting heavy weights came second, followed by mishaps involving chemicals, hand tools, strains, power tools, and falls.

National Safety Council statistics show fatalities brought on by common mishaps continue to outdistance deaths caused by all the known dreaded diseases combined. Accidental deaths run into tens of thousands every year and injuries into millions.

Why does this parade of accident facts keep marching before us year after year without any noticeable reduction in numbers? The National Safety Council offers this answer: "People have to be convinced that accidents, even the most serious ones, can happen to *them*. They must be injected with an accident awareness through safety education programs before any appreciable reduction in deaths and injuries can be realized." The good record the pest control industry, attained by keeping casualties from toxic chemical misuse to a minimum through safety education, bears out the NSC's formula for accident prevention.

When two servicemen sit down after hours for a game of checkers or a hand of pinochle, they understand the rules of the game. If they don't, it will not be successful. A common set of rules is likewise important when a group of pest control operators work together successfully—and safely.

Starting a Safety Program

A modern safety education program proceeds on the theory that all accidents are preventable, and that both management and supervisors assume responsibility for making the working environment for employees as safe as possible.

First step in such a program is to discover and reduce serious hazards likely to be found in a pest control firm. Management should appoint someone safety director to find out what must be done to improve unsafe conditions and to plan safety education. This person must be delegated proper authority and necessary money and assistance to achieve his desired goals or the safety program is apt to be sterile. Some pest control firms have full-time safety directors or coordinators whose sole job is devoted to establishing safeguards and security.

Three basic moves must be made to start any successful safety program: 1. establish regular and carefully planned inspections of facilities for unsafe practices, 2. organize a carefully planned program of safety education, and 3. insist on prompt and proper accident reporting and analysis by each employee.

Safety Inspections

Before effective accident control measures can be launched, the extent and nature of existing and potential hazards must be known. To find out what they are, management must get a general inspection made and see to it that a written report of the findings is made and turned in.

A safety inspector must consider the basic layout of storage space, shelving, and equipment as important factors in the safety and efficiency of a pest control firm. While requirements will vary from company to company, the question to ask is: Will this particular storage and equipment layout afford the safest working conditions possible?

Proper housekeeping practices are essential. There should be no question about the manner in which waste material and empty containers are to be disposed. The directions for keeping floors, espec-

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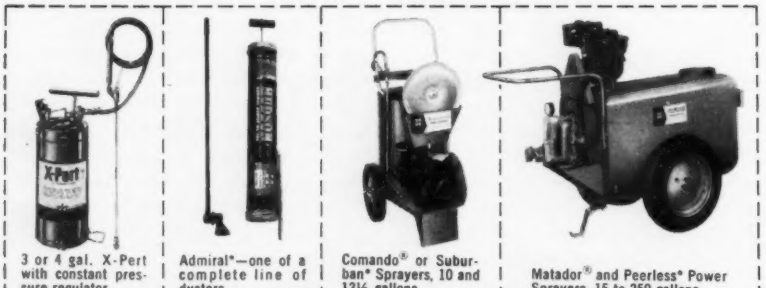
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ially in frequently traveled areas, free and unobstructed must be understood by all employees. This will reduce the possibilities of trips and falls.

In the pest control industry, ventilation of workshops is an important link in a safety chain because of the toxic materials PCOs use and store.

An inspector must be certain proper ventilation serves two purposes: it must remove dusts and/or vapors from the air so they will not constitute a hazard, and must maintain a healthful working temperature without creating unhealthy drafts. A safety director should check ventilation codes in his community to see if his ventilating equipment meets local and state standards.

A regular and systematic check of hand tools is necessary if accidents are to be avoided. Such inspections may well become part of the safety education program in which employees themselves may be asked to regularly examine edge tools, their handles, etc.

Because defective or misused power tools cause the most serious accidents through electric shock and burns, inspectors must give constant attention to them. Ground wires of electrically powered equipment must be checked regularly for flaws or breaks in insulation and connections. An inspector cannot overstress this point to employees.

While safety inspections are the backbone of an accident prevention program, they alone cannot uncover all unsafe conditions existing in a company. Reviewing causes of past injury cases and watching employees so they will not repeat practices that have caused injuries in the past are two additional means of detecting accidents before they happen.

Accident Reporting and Analysis

A weakness of most PCO safety programs is the failure to keep adequate accident records. This is one area in which a safety coordinator can take immediate steps for improvement.

A good report should promptly list the circumstances that led up to the direct cause of an accident and the nature and attention injuries received. The National Safety Council provides, free of charge,

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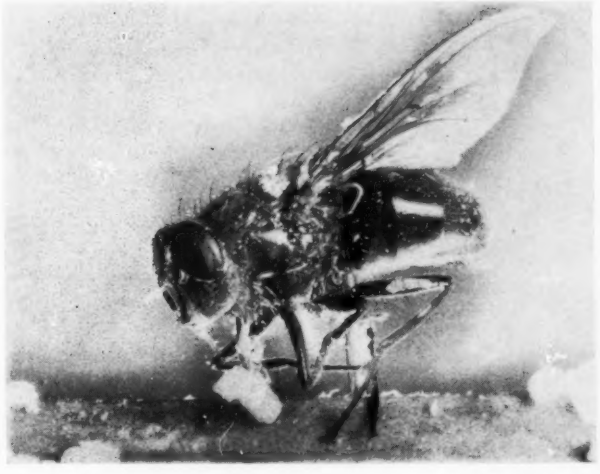

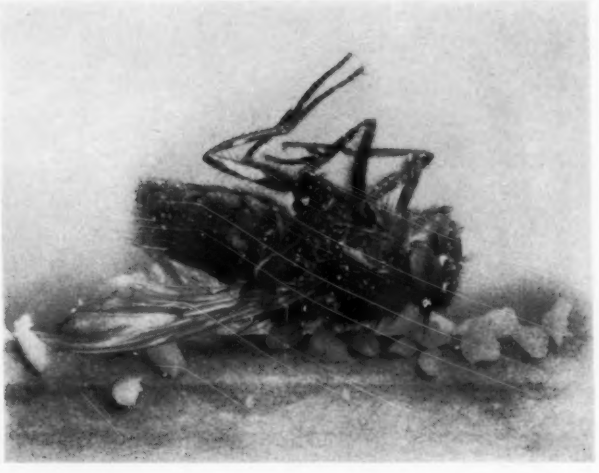

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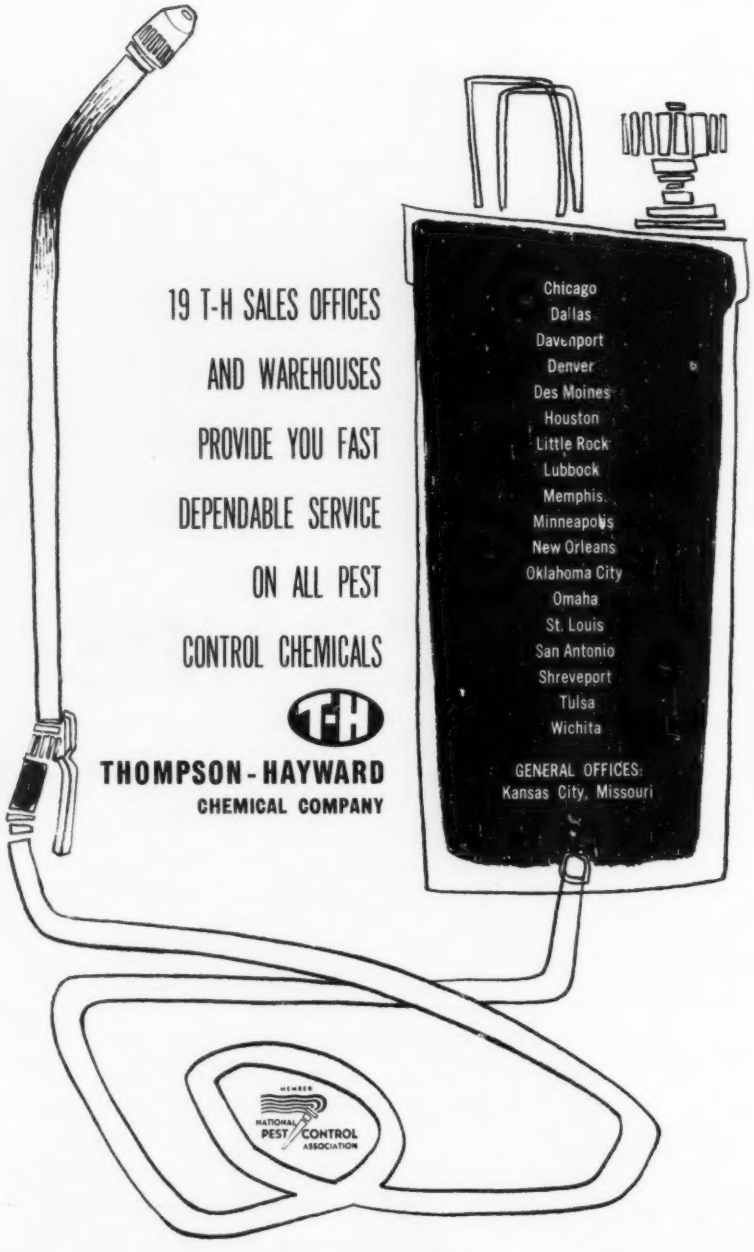

report forms and summary sheets to cover most anticipated industrial accidents. These can be obtained from the Council's headquarters at 425 N. Michigan Ave., Chicago, Ill., and can be used as a basis upon which an accident reporting form for a pest control firm can be prepared. All reports should be reviewed and analyzed at least twice a year.

Office Safety

People usually do not intend to do things which are obviously dangerous, like putting their fingers too close to an office fan or plugging an electric typewriter into an outlet with wet hands. Thus, far more people are injured when they do things which seem safe, such as leaning too far back in a chair or inadvertantly closing a door in someone's face. This makes one principle of accident prevention plainly visible — some of the most serious and frequent causes of injury do not appear to be dangerous at all.

Because every minor accident has the potential of serious injury, the following safe practices should be encouraged and may become the "curriculum" in an office safety program:

1. Use and keep flammable duplicating liquids far from flame or heat.
2. Keep the power switch of electric typewriters turned off when not in use.
3. Do not attempt to force stuck windows by strength alone. This is a job for a maintenance man and his tools.
4. Keep desk and file drawers closed when not in use.
5. Do not sit on the edge of or lean too far back in a chair.
6. Maintain control of a desk typewriter ledge when lifting it into position.
7. Pointed handles of desk pen and pencil sets should be faced away from the user.
8. Keep work space clean so that you can see everything that's on your desk.
9. Close doors of safes, vaults, etc. by using the handle. Never grip the rim.
10. Load file cabinets from the bottom so they won't be top heavy and tend to topple over.
11. Keep pencil sharpeners and typewriter carriages from jutting out into the aisle.

These rules may appear to be "piffle" and too minor to worry about in an industry where poison gases, chemicals and high-powered tools prevail. But it is surprising how violation of such basic rules has accounted for many accidents and some lost time.

Obstructions that protrude from the floor, such as riser plugs, radiator valves, etc., as well as exposed

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pipes, heavily waxed floors, and crowded working space are just some of the unsafe conditions that account for injury to office workers. There are many more that can be found in any office. These can only be spotted by searching for them.

Tools Can "Boomerang"

Defective or misused PCO tools can be cited as a major cause for cuts and scratches. Servicemen often use hammers, chisels, saws, hatchets, picks, shovels, spades, and other sharp-edged implements to get at the core of an infestation. Any one of these useful tools can boomerang and become destructive cutlery when used clumsily or is in need of repair.

Hands and eyes are most frequently injured by misuse of chisels, saws, hammers, and hatchets. To protect these and other parts of the body, follow these precautions:

Keep handsaws sharp and properly set for easier cutting. A crosscut saw should be used for cutting *against* the grain of wood and a ripsaw for cutting *with* the grain. When starting to saw, take only one or two long, slow cuts upward, guiding the tool with the left hand. After a definite start has been made, take the hand away from the cutting area and continue sawing. If the blade is kept in a direct line with the cut, it will move more easily. Sudden binding, which may throw the operator off balance and cause an accident, is reduced. A saw should always be hung up securely after use.

Avoid "Mushrooming" Chisels

A cold chisel must be made of steel hard enough to withstand blows without "mushrooming" excessively at the top, but not so hard that it will chip or check. When this "mushrooming" or spreading begins to occur, the head of a chisel should be ground down to restore a flat top. Split or rounded chisel heads increase the likelihood that a hammer or sledge will glance off and strike the hand holding the tool.

To use a chisel properly, grasp it firmly so it will not waver or slip. And wear goggles to protect eyes from flying chips. This is especially important when working with concrete or masonry block. If it is necessary for other servicemen to be nearby, they too should wear goggles. Always store a cold chisel in a tool box or drawer to eliminate the chance of accidently brushing against its sharp edge as it lies openly on a table or bench top.

Beware the Dull Edge

The size and shape of a wood chisel you select should be determined by the type work to be done. Injuries have often been caused by using a light wood chisel instead of a heavy one. A chief hazard associated with wood chisels is a dull edge. A user has to exert more pressure to dig into wood with a dull chisel and increases the chances of it slipping off into a hand or finger. Many serious cuts have been attributed to holding wood in one hand while chiseling with the other. If the chisel slips in this position, it is almost certain to strike the hand holding the wood. Never draw a chisel towards you when chipping wood. If it slips in this direction, the part of your body at the level of your work is an open target for

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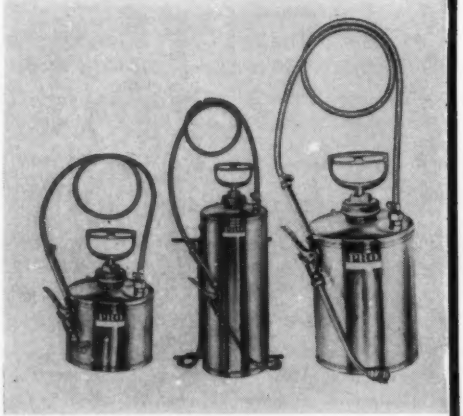

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the sharp edge. For obvious reasons, never grab at a chisel, or any sharp tool, if it starts to fall. It's better to let it break, than risk gashing open a hand.

Focus Eyes When Axing

When an ax or hatchet is used, be sure there are no obstructions in the path of the arc in which a tool is swung. A swinging ax can easily be deflected towards its user. Fingers, toes, and other parts of the body must also be kept out of line of swing so that if the ax misses or glances off its target, the operator will not get cut. Focus your eyes on the spot to be hit to improve aim and reduce chances of missing your target.

A single bit ax should be carried either on the shoulder with sharp edge outward, or in the hand at your side, grasping the tool just behind the ax head with sharp edge down. A double bit ax should be carried in the hand along the side. Belt axes and hatchets should be carried in a sheath. Of course, it is important to keep heads of axes, hatchets, hammers, and other swinging implements secure to keep them from coming loose and flying off to strike fellow workers.

With Power — Hazards

No one will dispute the fact that the invention of portable power tools has been a boon to the pest control field, especially in termite control. Greater speeds, lower production costs, and in most cases, greater accuracy are definite advantages.

With these benefits also came greater potential hazards. An operator can lose a finger before he realizes a safety guard is not functioning. The bit of an electric drill can glance off the work and drive deep into a termiteman's flesh in a split second — faster than he can release his finger from the power switch.

Servicemen should realize that danger of serious injury caused by power tools is far greater than with hand tools because of the speed at which power tools operate. These speed perils should be pointed out in no uncertain terms to every new serviceman who is about to use a power tool for the first time.

One of the most feared dangers associated with electrically powered implements is the ever-present possibility of electric shock. To reduce this contingency, all power tools must be grounded with a dependable ground connection.

Two systems of grounding may be used. One utilizes nearby water pipes, metal frame works of buildings, or other metal structures in direct contact with the earth to provide a low resistance path for the current to follow.

The other system uses a group of driven electrodes, buried plates, and strips, or similar arrangements in direct contact with the earth.

What Causes Shock?

All supervisory personnel should be acquainted with the electrically unsafe conditions that cause severe shock to workmen. Such conditions are:

1. A breakdown in the insulation of a tool's motor. This common shock producing condition can result if metal chips or water enter the motor. A badly worn spot on the cord at the point where it enters the motor housing, or a hard pull on the cord to loosen it

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where it feeds into the motor are two other causes of electric shock.

2. A breakdown in the insulation of the circuit so that the tool is grounded only when the switch is turned on.

3. A breakdown of the tool and circuit insulation on opposite sides of the circuit. This electrically unsafe condition makes safety of the tool dependent on the position of the prongs of a two prong plug in an electrical outlet; one position is safe while the alternate is not, and operators have no way of knowing which is which.

4. Low body resistance which offers the path of least resistance for electricity to ground itself to the earth. This condition can cause severe shock, powerful enough to electrocute an operator. A workman whose hands are wet, or even moist, from perspiration, has considerably lower body resistance. Resistance of the human body is normally about 100,000 ohms, but it will drop to 100 ohms or less when the skin is moist. The ohm drop is much greater when a person stands on a wet surface. To provide positive protection against electric shock from portable power tools, safe industrial practice requires that the tool should have a ground resistance of no more than 5 ohms, so it will provide less resistance than the operator's body.

Make Drill Fit Job

The portable electric drill is probably the most widely used power tool in the pest control industry because of its importance in termite control applications. A thorough study of the proper use of this tool will help reduce accidents.

A drill bit should be carefully selected to fit a specific job; its length should be no longer than the job requires. If an operator must guide a drill with his hand, a special sleeve should be fitted around the drill bit to protect his hand. This sleeve also serves as a limit stop to control the depth of a drilled hole.

Shanks of heavy bits should not be ground down to fit chucks of smaller drills. Either a drill with a bigger capacity chuck or a small chuck drill with a special adapter should be used. Such an adapter is equipped with a speed reducer gear and prevents drill overloading and overheating.

To avoid excessive pressure always use sharp drills. And never change the direction or pitch of a hole after a drill has started its work. This mis-practice causes the shank or bit to snap and possibly fly towards the operator.

To be sure of protection from flying bits, concrete chips, etc. always wear safety goggles when you drill. Goggles should be used when you operate most power tools.

Of course, you will use such important protective equipment as dust masks, gas masks, gloves, respirators, ointments, etc., when they are called for in a particular job. If not, you are inviting tragedy to strike.

Knees Bent, Back Straight

Almost every PCO at some time or other, handles, lifts, carries, or lowers heavy drums, sprayers, compressors, and other equipment. Doing this recklessly will cause injury to hands, feet, or back.

Before lifting a load, take a good look at it. Estimate its weight, and decide whether it is better to grip it at the bottom, at its side, or if you should get some assistance. If you think you can handle it alone, get a firm footing, crouch down to the object, bend your knees, and keep your back almost vertically straight. Get a comfortable, secure grip and straighten knees, rise slowly, keeping the load close to the body. By lifting in this fashion, most of the weight is carried by your strong arms and leg muscles. The likelihood of back injury is lessened.

The actual number of pounds a person can handle safely depends upon the individual.

Well Worth It

Accidents don't just happen, they are caused. The cost of lost time and money spent for treatment of injuries run well into the hundreds of thousands of dollars annually. The little time and money it takes to organize a safety plan for a pest control firm is a priceless investment.

If you have not already begun a safety education program, take steps to do so now. You will help yourself and your business, but more important, protect the life of your employees and customers.

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Charles E. Beach is elected CSMA president.

Achievement Award goes to Ira P. MacNair.

Atmospheric concentrations remaining when DDVP is used according to recommendations are below those known to cause organophosphorus poisoning in animals or man. This was the report made by E. A. Neuwirth, of Shell Chemical Co., to the Chemical Specialties Manufacturers Association's 47th annual meeting in Hollywood Beach, Fla., Dec. 5-8.

Speaking before the CSMA's insecticide division, Neuwirth detailed experiments made in conjunction with Shell's T. T. White at the firm's Union, N. J., technical service laboratory. Purpose of the tests was to establish whether or not practical methods of applying Vapona (Shell's brand of DDVP) insecticide present a hazard to inhabitants of a treated dwelling. They determined the concentrations of the vapor-toxic insecticide during and following application.

In addition to recommended dosages, several varying strengths of the toxicant were tested to obtain vapor concentrations in excess of those normally encountered in pest control work, Neuwirth explained. Test data revealed that the highest atmospheric concentration encountered, using recommended dosages or excessive dosages under practical conditions, was below that known to cause clinical signs indicative of organophosphorus poisoning.

One half-day of the four-day convention was devoted to discussions of importance to insecticide manufacturers. Concurrently there were other divisional sessions covering detergents and cleaning compounds, waxes and floor finishes, aerosols, automotive specialties, and disinfectants and sanitizers.

Dr. Alfred Weed, of Olin Mathieson Chemical Corp., chaired the insecticide division program which included presentations by the U. S. Department of Agriculture's Thomas H. Harris, Clarence G. Donovan, and Robert L. Caswell on the role of chemistry in the administration of the Federal Insecticide, Fungicide and Rodenticide Act; USDAman C. C. Fancher who explained his Department's imported fire ant control program; and Miss Jane Lewis who described the role of her Business and Defense Services Administration branch of the Commerce Dept. in government and industry.

Ira P. MacNair, president of the MacNair-Dorland Co., New York, was awarded the association's 1960 Achievement Award. He served the CSMA as its secretary from 1936 to 1941, and has made many contributions to the chemical specialties industry. At one time Mr. MacNair was a director of Trade Magazines, Inc., publisher of *Pest Control*.

Newly elected president of the association is Charles E. Beach of John C. Stalfort & Sons, Inc., Baltimore. Other officers picked at the Hollywood meeting are Charles E. Allerdice, Jr., The Bell Co., Chicago, first vice-president; Donald J. Templeton, Stanley Home Products, Inc., Easthampton, Mass., second vice-president; Frederick G. Lodes, Lodes Aerosol Consultants, Inc., New York, treasurer; and Alfred A. Mulliken, CSMA, secretary.

Next meeting of the association is its Chicago conclave at The Drake Hotel May 15-17.

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by

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Head, Entomology Department, Virginia Polytechnic Institute, Blacksburg.

and

B. D. PERKINS[2]

THE EXISTENCE of field populations of the German cockroach that are resistant to chlorinated hydrocarbon insecticides, as well as to pyrethrins, is now generally recognized (Spear, 1958). In recent years there have been many reports of natural populations which have become difficult to control with certain organic phosphate insecticides. It was not until mid-year of 1960, however, that laboratory confirmation of such resistance was obtained when a strain of cockroaches from Kentucky[3] was found to be resistant to Diazinon (Grayson, unpublished; NPCA Technical Release dated July 15, 1960).

The principal objectives and results of previous studies on cockroach control at the Virginia Polytechnic Institute have been briefly reviewed (Grayson and Perkins, 1959). For a more complete discussion of insecticidal resistance and control in cockroaches the reader is referred to a recent symposium paper on this subject (Grayson, 1960).

The purpose of the study reported here was to continue the search for insecticides and formulations which may be effective in control of resistant and non-resistant German cockroaches. The strains used were the chlordane-resistant and normal ones maintained in the Department of Entomology of the Virginia Polytechnic Institute.

Materials and Procedure

Twelve formulations involving seven different materials (one in combination with an additional material) were included in the experiment. All were tested on tempered "Masonite" panels. The materials were as follows: Bayer 29,493 both technical grade and as a 47.5% emulsifiable concentrate (Chemagro Corporation); technical Butonate (Prentiss Drug and Chemical Company, Inc.); DDVP in Shell Sol-71, DDVP in Shell Sol-71 plus dieldrin, and DDVP as a 43.6% emulsifiable concentrate (Shell Chemical Company); Hercules 7522C as a 15% emulsifiable concentrate (Hercules Powder Company); malathion SF-60 as a 27% emulsifiable concentrate (American Cyanamid Company); Monsanto CP11223 as a 95% soluble concentrate (Monsanto Chemical Company); and technical Diazinon (Geigy Chemical Company). A refined kerosene was used in preparing the oil base formulations.

The procedures in rearing the cockroaches and treating the panels were the same as previously described (Jarvis and Grayson, 1957; Grayson and Messersmith, 1959).

The testing procedure consisted of placing female German cockroaches in battery jars containing three treated panels each. All of the tests were replicated four times except those for the 2-day aging period which was replicated three times. From 10 to 20 cockroaches were used for each replicate, the number depending upon the available supply. The cockroaches were continuously exposed to the treated panels for a 3-day period. Mortality readings were taken at the end of one and three days following exposure of the cockroaches to the treated panels.

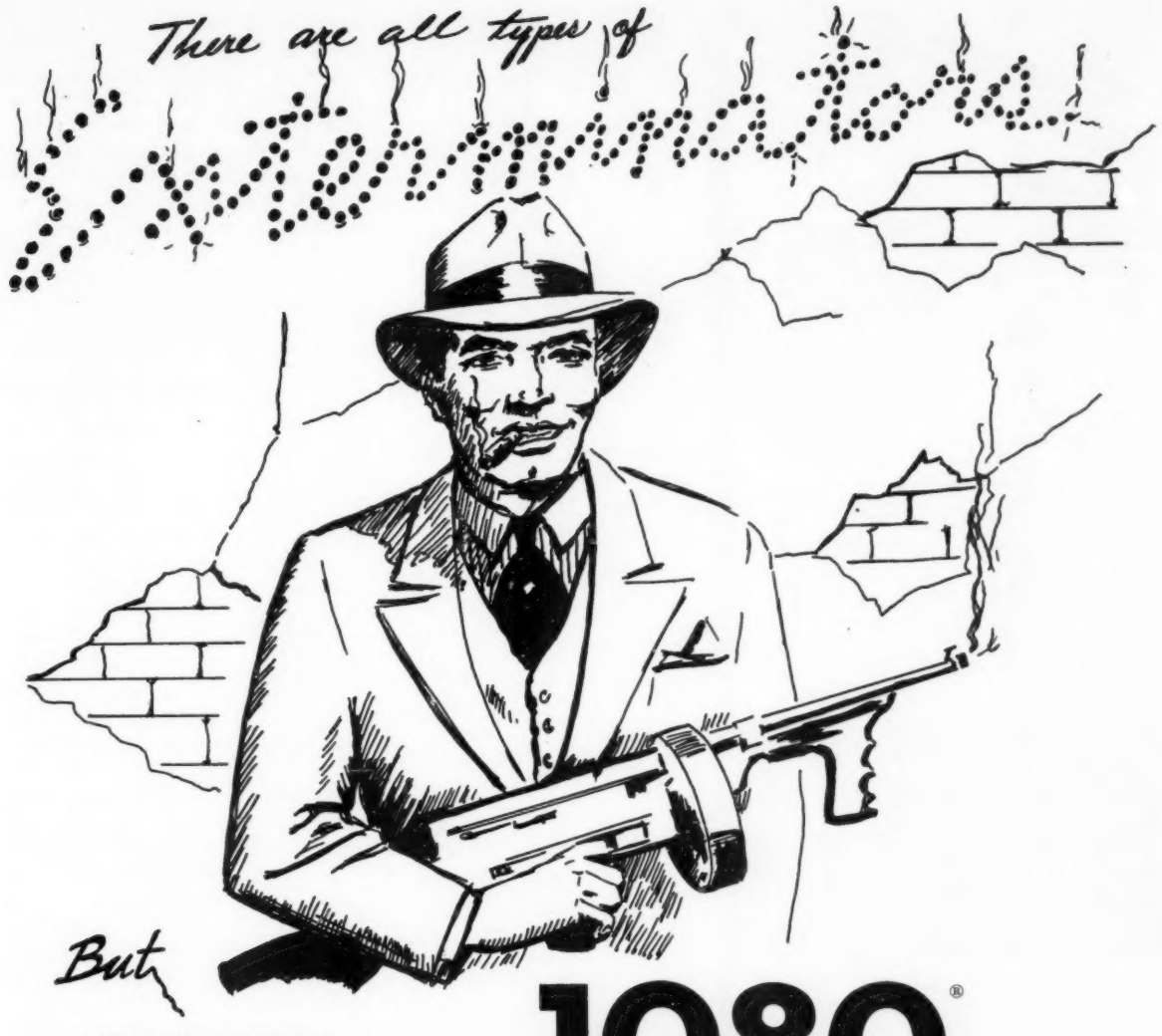
Results and Discussion

The results are shown in the accompanying table. A 2.0% water solution of Monsanto CP11223 gave near perfect kill of resistant and non-resistant cockroaches after 1 day of exposure to deposits that had aged for 60 days, while a 1.0% water solution of this material gave complete kill after 3 days of exposure to deposits that had aged for a similar length of time. Good to excellent kill was obtained from a 1.0% emulsion of Hercules 7522C after 3 days of exposure to deposits that had aged for periods up to 30 days, but the

1. Acknowledgement is made to the National Pest Control Association for grant-in-aid support of this work; and to Dr. P. J. Spear, Technical Director of N.P.C.A., for assistance in planning the work.

2. Graduate student in the department of Entomology, V.P.I. Mr. Perkins is now at the University of Hawaii pursuing graduate work leading to the Ph.D. degree.

3. The cockroaches were sent in by Mr. Elmer R. Jones, Owensboro, Kentucky.



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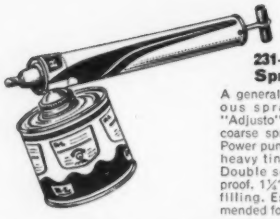

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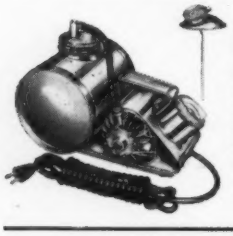

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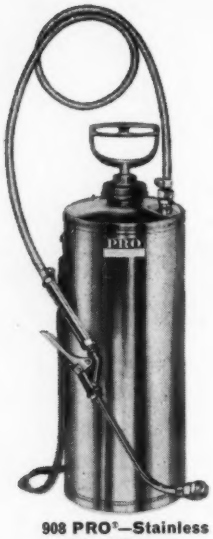

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effectiveness of this material was found to have declined after the deposits had aged for 60 days. Chemagro 29,493 as a 1.0% oil base formulation gave complete kill of resistant and non-resistant cockroaches after 3 days of exposure to deposits that had aged for periods up to 30 days, whereas a 1.0% emulsion of this material gave comparable results for periods up to 60 days. Deposits from a 0.5% oil base formulation of Chemagro 29,493 gave satisfactory kill for less than 15 days following treatment of the panels. DDVP, formulated either as a 0.2% solution in Shell Sol-71 or as a 0.2% emulsion, gave excellent kill up to 15 days but declined in effectiveness thereafter. However, the effectiveness of the 0.2% oil base formulation of DDVP was extended to 30 days when 0.3% dieldrin was added. Good to excellent kill of resistant and non-resistant cockroaches was obtained from a 3.0% emulsion of malathion SF60 after 3 days of exposure to deposits that had aged for periods up to 60 days, although in no instance was 100% kill obtained. An 0.8% oil base formulation of Butonate gave satisfactory kill for less than 15 days following application to panels. The results obtained from a 0.5% oil base formulation of Diazinon were similar to those obtained previously (Grayson & Perkins, 1960) except that the deposits appeared to be less effective after 60 days of aging than was found to be the case in the earlier test.

Better results would likely have been obtained from either Butonate or DDVP if these materials had been tested at higher concentrations. The manufacturers of Butonate now believe that 0.8% is too low to expect residual effectiveness from this material in cockroach control. The recent clearance for use of DDVP as a 0.5% oil solution by pest control operators under specified circumstances offers the possibility of this material having longer residual effectiveness.

Summary

The residual effectiveness of 12 formulations of 7 insecticides, and a combination of one with an additional insecticide, in killing female

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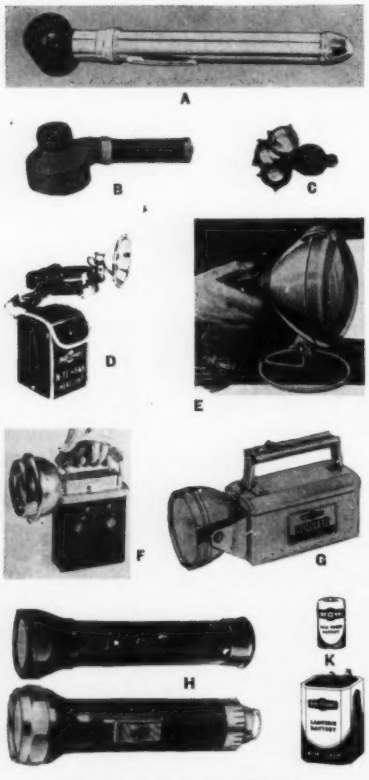

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Percentage mortalities at the end of one and three days* following exposure of female German cockroaches to panels which had been dipped in different insecticide formulations and the deposits allowed to age for various periods of time. 1960.

Insecticide and Formulation	Cockroach Strain	Age of Insecticide Deposit (Days)			
		2	15	30	60
Chemagro 29,493, 0.5% oil base	Resistant	87-100	33-83	4-57	0-9
	Non-Res.	100-100	23-83	9-75	9-31
Chemagro 29,493, 1.0% oil base	Resistant	100-100	68-100	61-100	19-60
	Non-Res.	100-100	83-100	55-100	43-97
Chemagro 29,493, 1.0% emulsion	Resistant	100-100	100-100	100-100	70-100
	Non-Res.	100-100	99-100	99-100	91-100
Butonate, 0.8% oil base	Resistant	83-96	0-12	0-2	2-9
	Non-Res.	76-95	4-10	1-4	0-4
DDVP, 0.2% in Shell Sol-71	Resistant	100-100	86-100	22-74	2-41
	Non-Res.	100-100	85-100	39-92	3-34
DDVP, 0.2% emulsion	Resistant	95-100	42-97	10-67	2-12
	Non-Res.	91-98	48-97	13-61	0-17
DDVP, 0.2% in Shell Sol-71 + 0.3% Dieldrin	Resistant	100-100	72-100	43-94	5-54
	Non-Res.	100-100	95-100	78-100	25-97
Hercules 7522C, 1.0% emulsion	Resistant	95-100	95-100	89-97	70-80
	Non-Res.	100-100	94-97	85-93	49-65
Malathion SF60, 3.0% emulsion	Resistant	76-98	95-97	92-99	81-98
	Non-Res.	79-97	77-98	86-99	67-91
Monsanto CP11223, 1.0% water solu.	Resistant	98-100	98-100	100-100	89-100
	Non-Res.	100-100	100-100	100-100	90-100
Monsanto CP11223, 2.0% water solu.	Resistant	100-100	100-100	100-100	98-100
	Non-Res.	100-100	100-100	100-100	100-100
Diazinon, 0.5% oil base	Resistant	100-100	97-99	86-100	44-98
	Non-Res.	100-100	100-100	96-100	62-94

*Under each column the first figure is the percentage mortality at the end of a 1-day exposure period, and the second figure is the same for a 3-day exposure period.

German cockroaches from resistant and non-resistant strains was determined. The materials were applied to tempered "Masonite" panels by dipping the panels in the different formulations and allowing the deposits to age for periods of 2, 15, 30 and 60 days before placing the cockroaches on them. Mortality counts were made at the end of 1- and 3-day periods of continuous exposure to the treated panels.

The periods of effectiveness of the various formulations, based upon 91 to 100% kill of cockroaches after 3 days of continuous exposure to the residual deposits, were as follows: (a) 60 days — 1.0 and 2.0% water solutions of Monsanto CP11223, 1.0% emulsion of Chemagro 29,493, 0.5% oil solution of Diazinon, and a 3.0% emulsion of malathion SF60; (b) 30 days — a 1.0% oil solution of Chemagro 29,493, a combination of 0.2% DDVP in Shell Sol-71 plus 0.3% dieldrin, and a 1.0% emulsion of Hercules 7522C; (c) 15 days — 0.2% DDVP in Shell Sol-71, and a 0.2% emulsion of DDVP; and (d) two days — a 0.5% oil solution of Chemagro 29,493, and an 0.8% oil solution of Butonate.

Failure of Butonate and DDVP to give longer residual effectiveness may be attributable to the low concentration levels at which they were tested. Perhaps they should be tested at higher concentrations to more fully explore their potentialities as residual insecticides in German cockroach control.

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Roach Film Available from CDC

A 13-minute color film for 16 mm sound projectors, "Biology and Control of the Cockroach," is available from the Communicable Disease Center.

Designed to train in the recognition and control of the cockroach, the film devotes footage to new insecticides for chlordane-resistant roaches. A film strip by the same title is also available for those who prefer it as a teaching aid. Both can be borrowed from the Audiovisual Dept. of the CDC, Atlanta 22, Ga.

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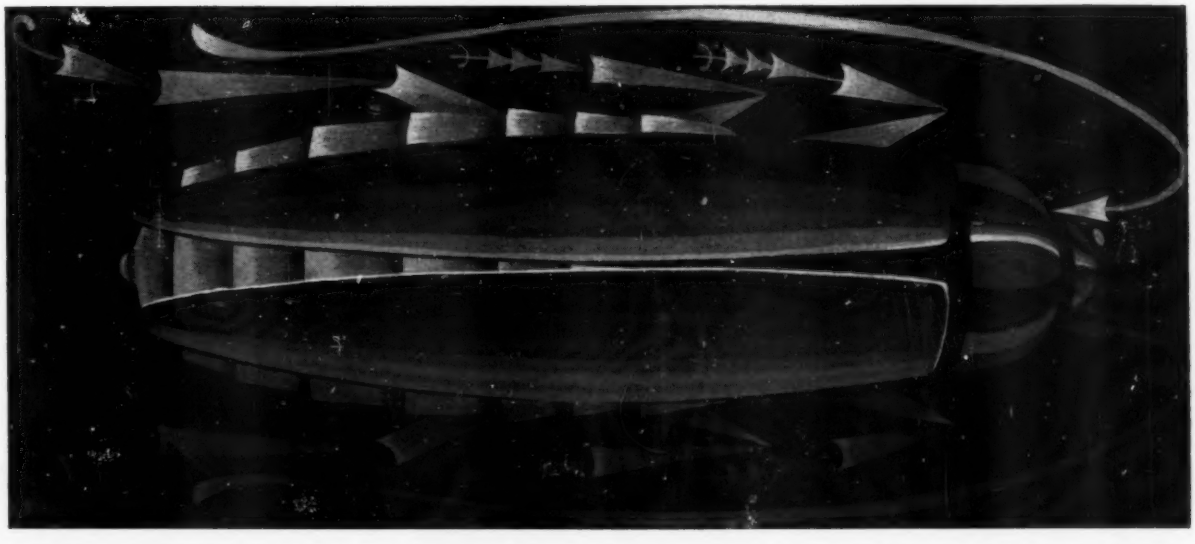

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1961 Regional PCO Conference Meets

Many months of work are now behind the preparation of these four major PCO conferences and the programs their sponsors have tailored are ready to be rolled out to anyone interested in structural pest control. These sessions are goldmines of valuable information to servicemen, supervisors, managers, and administrative personnel of pest control firms. There is no better way to accumulate up-to-date control methods than by attending one or more of these conferences. Industry suppliers will be on hand to demonstrate their equipment at exhibition booths. Following is a rundown of the registration fees, lodging facilities, and day-by-day programs of each of the first four regional PCO conferences to be held this year.

21st ANNUAL

Southern

PCO CONFERENCE

Hotel Heidelberg, Jackson, Mississippi

January 16-18, 1961

Lodging

Delegates are assured there will be enough rooms at the conference headquarters, Hotel Heidelberg, and are urged to make reservations directly with the hotel. Several motels or hotels in Jackson within driving distance of the Heidelberg are the King Edward and Robert E. Lee hotels, and Holiday Inn, Stonewall Jackson, and Congress Inn motels.

Registration and Fees

Advance forms for the $15 registration can be obtained by writing Stanley McKenzie, P.O. Box 189, Lake Charles, La., who is general chairman of the conference. Registration will begin on Sunday, Jan. 15. for those who do not register in advance.

Program Emphasis

Personnel, management, and selling problems will highlight the business end of the conference, while bird control, wood destroying organisms, spider control, and proper use of powders will accent the technical portion.

Program

Monday, Jan. 16: First two hours will be devoted to registration and booth exhibits by suppliers to the industry. First formal session will be a discussion and explanation of the correspondence course for PCOs. Talks on problems and control of wood destroying organisms will follow. Remainder of the day will be devoted to business with talks and discussions on management problems and accounting procedures.

Tuesday, Jan. 17: A discussion of the supplements to and changes in the Approved Reference Procedures will kickoff the day's program. This will be followed by a demonstration of the use of dusts and powders. The afternoon session will include expert advice on "How to Train Servicemen," an explanation of the NPCA Termite Warranty Program, and a discussion of current problems connected with spider control.

Wednesday, Jan. 18: Techniques of bird control and a seminar on sales approaches are planned for the morning. The conference will end at noon.

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Today nearly 1,000 attend similar conferences at universities across the country each year. 67 came to first in 1936.

25th SILVER ANNIVERSARY

Purdue

PCO CONFERENCE

Purdue University, W. Lafayette, Ind.

January 23-27, 1961

Lodging

Purdue Union Club, VanOrman-Fowler Hotel, Cedar Crest Motel, Morris Bryant Motel, Esquire Motel, and Green Acres Motel. The VanOrman-Fowler Hotel is located in downtown Lafayette and the motels on U. S. Highway 52, about two miles north of West Lafayette. Make reservations directly with the Union Club, hotel or motels.

Registration and Fees

Registration cost is $20 and includes attendance at all sessions, a conference manual, and ticket to the special Silver Anniversary banquet, Thursday evening. Registration forms can be obtained from Dr. John V. Osmun, Head, Department of Entomology, Purdue University, Lafayette, Ind. Checks should be made payable to Purdue University. Advance registration is suggested.

"Pest of the Year"

Cockroaches.

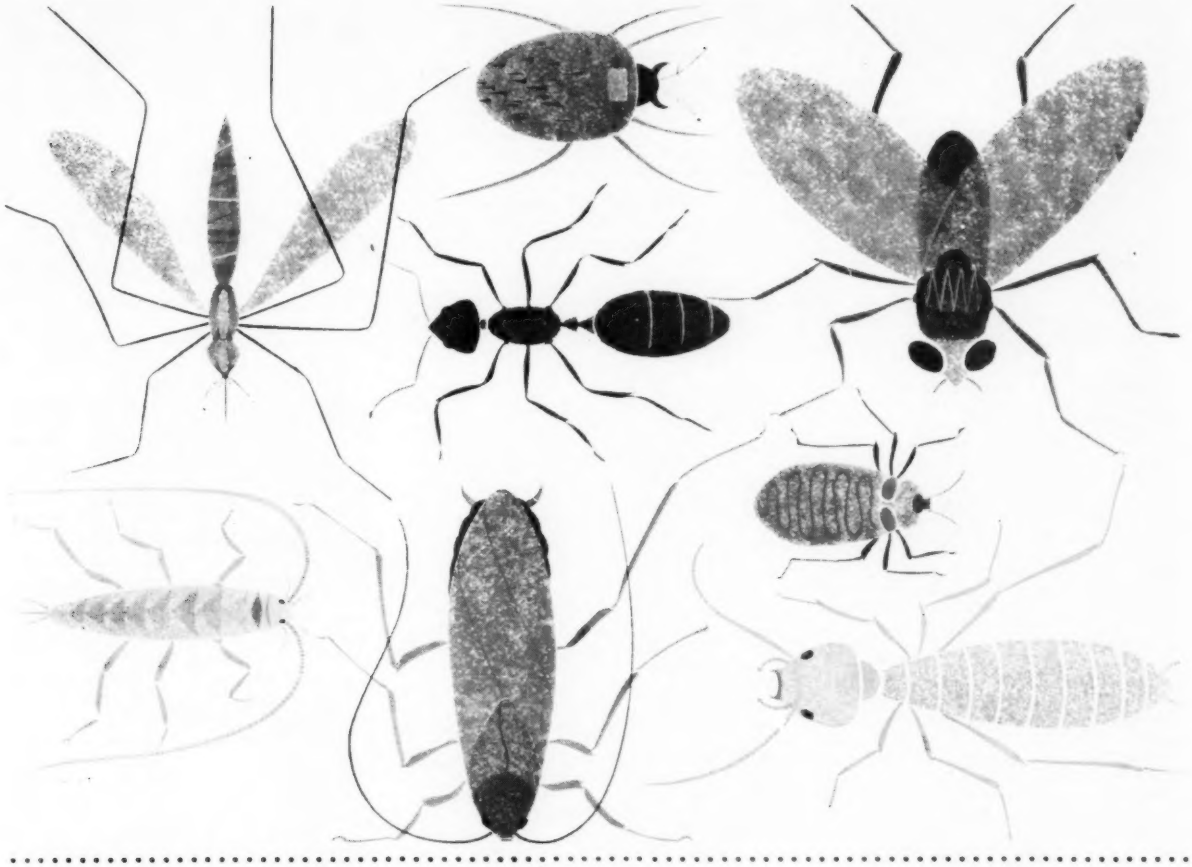
Program

Sunday, Jan. 22: Early registration at Purdue Union Building from 4-6 p.m. and 7-9 p.m. Central Daylight Saving Time. The evening is open for industry "bull sessions."

Monday, Jan. 23: Opening session will begin at 8:30 a.m. and will include a special new feature, being kept secret by the program committee. At 9:30 begins an all-day "Pestology" session featuring rotating classes on the forms of insects, their reproduction and growth, classification, insect control fundamentals, and identification of insects and their damage. Subjects will be presented by Purdue entomology staff members, Glen E. Lehker, Dr. B. E. Montgomery, Leland Chandler, R. C. Dobson, Dr. H. O. Deay, D. L. Matthew, J. K. Bready, and the department's chief Dr. John V. Osmun. The evening will be open for state meetings and new regional problem sessions.

Tuesday, Jan. 24: Purdue communication specialists will kickoff the morning program by presenting "The Key to Taking Home the Conference." This will be followed by a team of experts, headed by Joe Irvine of Arwell, Inc., who will recommend tips on training programs for servicemen. In the afternoon, Dr. Ralph Glasser of Shell Chemical Co., will talk on DDVP and "What You Should Know About It." Purdue PCO course instructor William Butts will explain how to apply DDVP and its limitations. U.S. Army official, F. W. Whittemore will make recommendations on how to prepare and dilute formulations. In the evening there will be two concurrent sessions, one on "Birds and Their Control," with William D. Fitzwater, assistant U.S. Fish & Wildlife Service district agent, and the other a panel discussion on suburban living pest control featuring G. E. Lehker, C. E. Knote, D. L. Matthew, D. L. Schuder, and H. R. Shuyler.

Wednesday, Jan. 25: Emphasis will be on cockroaches, the 1961 "Pest of the Year." Morning and afternoon sessions will include talks on: (1) "Roach Biology:



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Its Relationship to Inspections and Applications," by Lee C. Truman, Pest Control Services, Inc., Indianapolis, Ind.; (2) "Choosing Your Materials for Roach Control," by Clayton C. Wright, C. Wright Associates, Dallas, Texas; (3) "Dust Formulations and Their Application," by Myron T. Smith, Hill-Smith, Systems, Memphis, Tenn. and Arthur Gibson, Vogel-Ritt of Ohio, Cincinnati, O.; (4) "Liquid Formulations and Their Application," by Herman Fellton, Getz Exterminators, Inc., Atlanta, Ga.; and (5) "Laboratory Identification of Roach Eggs and Nymphs," a laboratory session conducted by Purdue's Dr. Howard O. Deay. In the evening, NPCA Executive Secretary Dr. Ralph E. Heal will explain "What the Termite Warranty Program Will Do for You."

Thursday, Jan. 26: The morning program will be devoted to termites and their control. Dr. Osmun will present an up-to-date report on "Soils and Termite Chemicals;" Dr. Horace O. Lund, Head entomologist at Georgia University, will report on his studies of termite tubing over treated wood; Virgil Smith, of the U. S. Forest Service's Gulfport, Miss. laboratory will discuss "What We Still Need to Know About Termites;" and Robert C. Yeager, Rose Exterminator Co., Cincinnati, O., will present "Practical Problems on Estimating Quantities and Pricing Jobs." The afternoon will pinpoint what such PCO customers as bakeries, bottlers, and grain companies expect of the PCO and what his responsibility is to these industries. During this segment Dr. Lloyd Barron, National Biscuit Co., will recommend to delegates how to overcome special problems connected with large national bakeries. A special "Silver Anniversary" program and banquet will highlight the evening affair with Carl Winters, General Motors executive, as main speaker.

Friday, Jan. 27: U.S. Fish & Wildlife district agent Galen C. Oderkirk, and William D. Fitzwater, will lead off the last segment of the program with advice on "How to Tell the Rats from the Mice" and "Proper Preparation and Placement of Bait." A talk by S. Richards, of North Dakota, on Rabies, and one by W. L. Butts on "Safety and the PCO" will precede a closing panel discussion labeled "The Sounding Board."

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21st ANNUAL

Eastern

PCO CONFERENCE

University of Massachusetts, Amherst

January 25-27, 1961

Lodging

Lord Jeffrey Inn, Drake Hotel, and Amherst Motel, all in Amherst; Hotel Northampton, in Northampton, and the Country Belle Motel and Spruce Hill Motel in Hadley. For rooms in dormitory at the University, write directly to Harold Durgin, Student Union, University of Massachusetts. Dormitory rooms must be paid for in advance. Make checks payable to Convention Services. All other reservations should be made directly with the hotel or motel concerned.

Registration and Fees

Advance registration forms can be obtained from Frank E. Bohman, 102 Knollwood Road, West Hartford 10, Conn. Registration fee is $20 and includes conference manual, attendance at all sessions, and banquet ticket.

Program Emphasis

Dermestids: identification, biology, and control. Roach resistance and control. Visual aids to promote sales. Control of Thysanura, Collembola, termites, and biting flies. "New Business — Where?", Insurance coverage, and new developments in the industry.

Program

Wednesday, Jan. 25: Registration will be held in the lobby of the Student Union Building at 8:30 a.m. Conference chairman Sidney J. Heal, Griggs and Browne, Providence, R.I., will open the conference at 9 a.m. Following greetings by Dr. John H. Lilly, Head, Department of Entomology and Plant Pathology Department, the remainder of the day will be devoted to panel discussions. Among topics to be presented are "Biting Flies and Their Control," chaired by Frank Harder, Harder Extermination Service, Hempstead, Long Island, with Dr. Hugo Jamnback, Science Service, Albany, N.Y., and Robert Armstrong, superintendent, East Middlesex Mosquito Control Project, as panel members. "Control of Thysanura and Collembola," chaired by Kenneth Cook, Ransford Pest Control, Worcester, Mass., with Hamilton Laudani, Stored Products Insects, USDA, and Dr. Harvey Sweetman, University of Massachusetts, as panelists. "Termite Control," will be covered by Dave Feinson, Atlantic Exterminating Co., New Rochelle, N.Y., and Dr. Philip J. Spear, NPCA Technical Director. A final panel will be headed by J. J. Hess, Exterminating Services Corp., New York City, and will feature "New Business — Where?" Wednesday evening a special program lead by Dr. Ellsworth H. Wheeler, of the University, will feature the school's Professor Raymond Wyman with "Sell More the Visual Way." This program will present ideas of value for improving sales and also tips for those who are called on to discuss pest control before service groups and other civic gatherings.

Thursday, Jan. 26: The morning session, headed by Dr. Harvey Sweetman, will open at 9:30 in Room D., Fernald Hall. As an introduction, NPCA slides of dermestids will be shown. The group will then de divided into sections and will study the recognition of dermestids in the laboratory. The afternoon program will be held in Room D, Fernald Hall, with Dr. William Tunis of the University presiding. Featured will be Hamilton Laudani who will discuss the biology and control of dermestids. J. J. Hess will conduct a panel discussion on carpet beetle control and I. B. Carncross, Syracuse Chemical Co., Syracuse, N.Y., will discuss control of the khapra beetle. At 7 p.m. the annual banquet will be held in the Lord Jeffrey, with Charles W. Houghton, NPCA executive vice president, acting as toastmaster.

Friday, Jan. 27: The program will be held in the Council Room of the Student Union beginning at 9 a.m. Chairman will be Cyril A. Chafe, Jr., vice-chairman of the conference. Featured speakers will be Dr. James McD. Grayson, Virginia Polytechnic Institute's Entomology Head, who will discuss research on roaches at VPI, Robert Showalter, NPCA's executive assistant, who will talk about insurance needs of the PCO, and Dr. Spear, who will present some new developments of importance to industry members.

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12th ANNUAL

Pacific Northwest

PCO CONFERENCE

Imperial Hotel, Portland, Oregon

March 5-8, 1961

Lodging

Rooms will be available at the Imperial Hotel if reservations are made directly with the hotel early enough. Benson Hotel, Sheraton-Portland Hotel, Roosevelt Hotel, Portland Travel Lodge, and Thunderbird Motel are within driving distance of the convention headquarters.

Registration and Fees

Information on advance registration can be obtained by writing Claude Snow, Snow Insecticide Co., S.W. Capitol Highway, Portland 19, Ore. Registration will be held from 2 to 5 p.m. Sunday, March 5.

Program

Sunday, March 5: A 2-hour "hospitality" session will be held immediately following registration.

Monday, March 6: Men and women can attend a joint breakfast at 7:30 a.m. where introductions will be made of representatives from colleges, governmental agencies, and local health departments. First formal meeting will feature control of termites, ants and other wood destroying insects, fungi, and vapor barrier installations. Suggestions from sales experts on how to sell services will also be offered delegates. The afternoon session will feature Fred Switzer, executive secretary of the Pest Control Operators of California, Inc., talking on "Business Procedures." The program will be rounded out with presentations by J. D. Patterson, chief chemist Oregon Department of Agriculture, on "Safe Handling of Toxic Materials;" NPCA President Maurice Oser on "Need for Combined Efforts of All Pest Control Firms;" and Dr. Ralph Sullivan, of Oregon's State Department of Health, on "Necessity of Coordination Between the Pest Control Industry and the State Health Department."

Tuesday, March 7: Rodents and their control will be stressed at the morning meeting which will begin with a discussion of rodents and their relation to public health. Rodenticides, baits, bait stations, new materials and repellents, sales techniques on rural and community rodent control, and ABC's of grain fumigation and control of stored grain pests will also be covered. The afternoon meetings will include "Insect Identification," by Robert L. Furniss, U. S. Forest Service entomologist, Portland, as well as discussions of business ethics, sales promotion, and uniform accounting. A business meeting of delegates will be held at 4 p.m. when the annual election of officers will take place. The annual banquet will be held at 7:30 p.m.

Wednesday, March 8: Speakers on moths, carpet beetles, roaches and flies will start off the morning session. Norman Ehmann, of Neil A. Maclean Co., Los Angeles, Calif., will close the conference with a talk on bird control methods.

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Old Stand-bys, PDB and Naphthalene, Will Suppress Post-Treatment Swarmers

by HARRY KATZ

Elco Manufacturing Company, Pittsburgh, Pennsylvania

An investigation by Anders E. Lund, of Koppers Co. Research Laboratories in Verona, Pa., this past summer has resurrected two of the PCO's oldest chemicals, paradichlorobenzene and napthalene, as auxiliary tools for termitemen.

New tests of these two oldtime materials were touched-off when W. Regis Murphy of Elco Manufacturing used a pound of PDB crystals on a job to control alates that began to emerge during his inspection of the premises. He spread the material on the floor of a 5x5 foot basement bathroom and closed the door. Eight minutes later he returned to find the swarmers on their backs.

When Lund heard of this he agreed to test the efficacy of both PDB and naphthalene on cultures of subterranean termite alates and workers he maintains in his Koppers' laboratory to use in his studies on the nutritional significance of fungi for termites (PC Feb. '60, pg. 26). *Reticulitermes virginicus* species were used in this new test.

PDB Has Faster Kill

Using .1 gram of each toxicant in 150 cc petri dishes, Lund got the same response with both materials. Muscular disorientation was recorded in 5½ minutes, immobilization in 30 minutes, and complete kill in four hours. Repeated tests bore the same results. Alates were killed significantly quicker with PDB than with naphthalene. PDB was only slightly better than naphthalene on killing workers.

The time discrepancy between Lund's tests and Murphy's observation of an eight-minute kill could be attributed to the difference in the metabolic rate between swarming and preswarming alates.

When can a TO use these materials to control subterranean termites? Before this can be determined several of their properties must be considered. Naphthalene is less volatile than PDB. It is longer lasting and more pungent to some people. However, in the quantity likely to be used on a termite job, 2 to 10 lbs., no odor problem is likely.

A mixture of the two materials is useful but this must be done just prior to each job. When PDB and naphthalene are mixed and stored, the melting point of the combination is lowered and causes it to liquefy and lump at room temperatures.

Safety of both products has been well established so there is no hazard to man or pets presented by either of the two, especially when used under slab foundations.

Saves Embarrassment

It must be emphasized that these two materials should not be relied on to give long term control. They are only auxiliary weapons and their principal value is to suppress alates when work is being done during the swarming season. A common source of embarrassment to TOs is the presence of a swarm immediately after they treat a premise. This can happen when termites in scrap wood under a slab are burried beyond a treated area and emerge through treated soil to the surface. There is little distinction to the client between sluggish or lively swarmers. To eliminate as many of these "red-faced" situations as possible, use the two "vaporants" immediately after your regular treatment.

PDB and naphthalene can also

(*Continued on page 43*)

Volatilization is Big Factor in Stability of Termiticides in Soil

by H. R. JOHNSTON*

Southern Forest Experiment Station, U. S. Forest Service, Gulfport, Mississippi

We often use the word "breakdown" to describe any and all factors that contribute to the disappearance of a chemical, but perhaps this is not a very good word to use when we talk about termite soil poisons.

"Breakdown" includes *decomposition*, which means to separate into constituent parts or elements. For example, alkalies decompose benzene hexachloride, and iron decomposes DDT; that is, the chemical reactions result in compounds that are no longer benzene hexachloride or DDT. We are not too much concerned with actual decomposition of chemicals in soil for research has shown that several chemicals remain effective in soil for many years. "Breakdown" also includes volatilization together with factors that influence it, as well as other factors that affect the permanence or disappearance of a chemical in the soil.

Volatilization means to evaporate without the remaining compound being changed. Possibly volatilization is one of the biggest factors that influences chemical stability in soil.

Some of the things that affect the rate of volatilization are:

(1) The nature of the chemical itself. Chemicals with high vapor pressures volatilize or evaporate more rapidly than those with low vapor pressures.

(2) Temperature. It has been proved conclusively that temperature exerts much influence on the rate of evaporization; the higher the temperature, the faster the rate of volatilization. Soil cover, in

*This report is abstracted from a paper given by Mr. Johnston at the Georgia, North and South Carolina Tri-State PCO meeting, August 4-6, 1960.

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9/32 - 4	1.33	2.66	3.33
9/32 - 6	1.33	2.66	3.33
5/16 - 4	1.40	3.33	4.00
5/16 - 6	1.40	3.33	4.00
3/8 - 4	1.53	3.73	4.40
3/8 - 6	1.53	3.73	4.40
7/16 - 4	1.73	3.86	4.54
1/2 - 1/4 sk	2.00	4.00	4.67
1/2 - 3/8 sk	2.00	4.00	4.67
9/16 - 6	2.26	4.40	5.06
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turn, affects soil temperatures. Certain chemicals persist longer in shady plots than in sunny areas.

(3) The formulation of an insecticide affects the rate at which it volatilizes. For example, in relatively short-term tests with certain chlorinated hydrocarbon solutions, those in heavier oils are effective for a longer period of time than are water emulsions. Additives may prolong effectiveness. However, in long term tests it is doubtful if this will hold true. Some of the recommended termiticides we have under test are still effective in both water emulsions and oil solutions after more than 10 years.

Other factors that affect the persistance of chemicals in soil are:

(1) *Soil types.* Some chlorinated hydrocarbons persist longer in soils having a high organic content than in sandy soils with a low organic content. On the other hand, more insecticide is required to be effective against insects in high organic soils. Apparently organic matter ties a chemical in the soil, but in such a way that all of it is not effective against insects.

(2) *Soil moisture.* Chemicals are more persistent in dry soils than in soils that are wet, and probably least persistent in soil that is alternately wet and dried. Chemicals are possibly affected by microorganisms, although this has not been demonstrated. The rapid disappearance in wet-and-dried soils could be due to co-distillation where some of the chemical is extracted along with water as it evaporates. Leaching may also be a factor in wet soils.

(3) *Rate of application.* Slightly higher percentages of certain chemicals remain in soil when high rates of application are used. Results of tests at Gulfport conclude that the higher rates of application prevent termite attack longer than lower rates.

(4) *Alkalinity or acidity* of soil. The amount of alkalinity in soil probably exerts some influence on chemical stability, but the extent apparently has received little attention as yet.

Chemicals currently recommended for termite control and the period of time in which they are effective in light sandy loam soil in South Mississippi are listed below in alphabetical order:

Aldrin, 0.5%. Under test for 10 years and still 100% effective.

Benzene hexachloride, 0.8% gamma. Under test for 11 years, 80% effective for 10 years. These tests have been terminated.

Chlordane, 1.0%. Under test for 11 years and still 100% effective.

Dieldrin, 0.5%. Under test for 10 years and still 100% effective.

DDT, 8.0%. 90% effective for 11 years. Tests have been terminated.

Heptachlor, 0.5%. Still 100% effective after 5 years' exposure.

Dow's new flashing stretched over top of a concrete block foundation wall.

Dow Markets Elastic Flashing

A thin-gauge flexible sheet for elastic through-wall flashing, a material that may be applicable in subterranean termite pretreat jobs as a vapor barrier, has been developed by The Dow Chemical Company.

Trademarked Saraloy 200, it is recommended for most waterproofing and flashing applications that do not involve direct sunlight.

The new material is described by Dow as a tough, flexible sheet finely embossed on one side to provide mechanical keying action in mortar joints, self-extinguishing, water and corrosion resistant, and easy to paint, to bond, and to fabricate. It is available in rolls, 36 inches wide and containing 200 square feet. For a four-page illustrated pamphlet describing the material in detail write the Building Products Sales Division of The Dow Chemical Co., Midland, Michigan.

PDB, Naphthalene for Swarmers

(*from page 40*)

be used to keep cement plugs from sinking after shrinkage. Dropping in several "moth balls" is time saving. Where the infestation is heavy, it is better to use several ounces of crushed naphthalene or PDB in smaller particle sizes.

During April and May of last year, some jobs done by the Elco firm were treated with naphthalene crushed flakes as a supplementary material to our regular termite chemicals. No swarmers emerged from any of these jobs. But, four "post operative" swarms did emerge in conventionally treated homes.

Results of Lund's tests give substance to early recommendations that PDB be used to mix with backfill near water sources in which contamination by water soluble concentrates is possible. Both naphthalene and PDB can also be considered where ethylene dibromide is being planned for application. At room temperature, PDB mixes with kerosene at the ratio of 1 to 3 by weight.

Termite-Infested Lumber Sale Spreads Infestation in Toronto

Part of the blame for a recent termite infestation outbreak in the east end section of Toronto, Canada has been laid to the sale of used lumber from infested structures.

City Controller William Dennison reportedly criticized present city building regulations which do not prohibit sale of such lumber from building demolitions. He said he will ask the Board of Control to order city officials to begin a "fight-to-the-death" campaign on the termites that are spreading from the affected east end of town.

He said he also feels there should be a law prohibiting the sale of a building until the owner obtains a certificate from the city stating the structure is termite-free.

Dry Rot Not Dry USDA Says

Decay in wood, often referred to as "dry rot" is caused by a fungus which cannot operate in dry wood, according to a bulletin from the U. S. Department of Agriculture.

Fungi seeds, or spores, which cause wood decay are found wherever there is a trace of moisture, on window sills, roofs, around plumbing fixtures, etc. In drier parts of the country, the booklet points out, decay is a minor problem.

For more information about wood decay and its control, write for the free 17-page illustrated booklet, "Wood Decay in Houses," available from the Office of Information, U. S. Department of Agriculture, Washington 25, D. C. Ask for Home and Garden Bulletin No. 73.

Hawaiian Termite Damage High

Repairs to buildings damaged by termites in the city and county of Honolulu reportedly cost a total of three million dollars in a single year. Repair costs run from 20 to 50% of permit values, Honolulu building inspectors report.

Subterranean termites are culprits in 75% of the total damage and are said to be found in almost every building on the Island of Oahu. Drywood termites are tagged with causing the remaining 25% of the damage.

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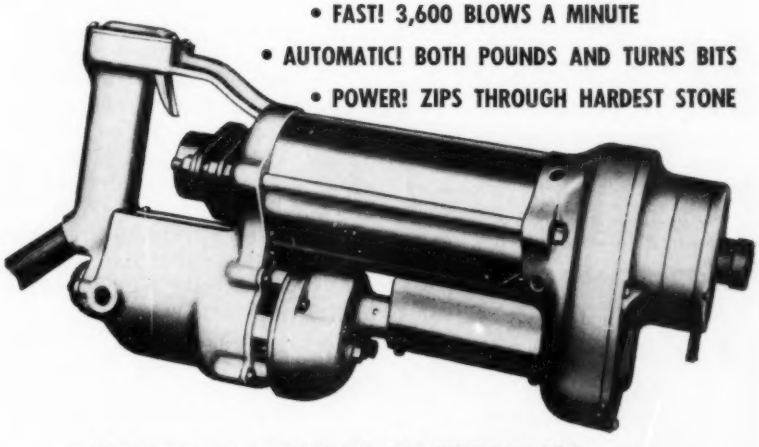

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Termites, Too, Might Become Resistant Butts Tells Ohio PCA Columbus Meet

"Termite resistance to chemicals might crop up at any time."

Such was the frightening prediction made by William L. Butts, head of Purdue University's PCO Course, before the 75 delegates to the Ohio Pest Control Association's 15th annual convention in Columbus, Nov. 30 - Dec. 2.

The Purdue instructor reported that termite resistance to soil poisons is not impossible and urged TOs to keep records of all termite service jobs to help detect the start of this dreaded situation.

"Give particular attention to areas where retreating is necessary. If return trips for treatment are necessary in any one specific area of the country, it could indicate something is amiss," Butts advised the Ohio group.

At another session, association president, James J. King, Newark Termite & Pest Control Co., Newark, emphasized the importance of selling the industry to the public. He said during the past year he attended meetings of the Insecticide Committee of the Ohio Department of Agriculture which was not aware that the pest control operators were an organized group. "This is a surprising revelation. It indicates that we know who we are, but who else does?" King stated.

As the first step in this "selling" campaign, the membership took action to advise telephone company officials to list in their yellow page directories all pest control operators under the heading of "Pest Control."

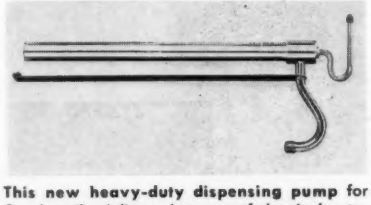
In other sessions delegates heard talks by Professor Emeritus J. J. Davis of Purdue U., on the "Past and Future of Entomology;" Howard Rosenbaum, of Mercury Chemical Co., who discussed various formulations of oil, water solutions, dusts, suspensions, etc.; Richard Grundstein, Beim Insurance Agency, who explained the "occurence" clause of PCO insurance contracts; Paul Drayer, DVM of Ohio State U's College of Veterinary Medicine who told of his association with PCOs; and Woodrow W. Slatzer, a cost accountant, who gave details on good cost accounting and how it can improve pricing structure.

In the more technical sessions, Ray Davis, of the Food and Dairies Division of the Ohio Dept. of Agriculture; W. O. Nelson, of the U.S. Fish and Wildlife Service, Minneapolis, Minn.; George Greenleaf, secretary of the Ohio Grain and Feed Dealers Association; and Howard Arbaugh, sales manager for Pyrrole Chemical Co., Portsmouth, participated in a discussion about rodent control with highly restrictive rodenticides, improper use of rodenticides, and potential regulatory action against such use. Completing the technical program were Billy D. Blair, extension entomologist at Ohio State U., who used slides to explain the biology and control of ornamental insects, and Dr. William Jackson, head of the Biology Department of Bowling Green State U., with a talk on roof and Norway rats.

At their business meeting as-

(*Continued on page 52*)

Strength and flexibility are two advantages this high pressure spray hose offers pest control operators, according to its manufacturer, Electric Hose and Rubber Co. It is said to be resistant to oil and chemical spray solutions and resists damage by dragging and exposure. For a complete list of sizes and length of the "Electric Multi-Purpose Hose," write the company in Wilmington, Del.



This new heavy-duty dispensing pump for 5-gal. pails, delivers 4-ounces of chemical automatically with each stroke and is being distributed by Hub States Chemical & Equipment Co. Its reported heavy construction and nickel-chrome plate is said to assure long life and guard against corrosive action by harsh chemicals. It is recommended for mixing formulations and for filling small bottles. Available from Hub States, 1255 N. Windsor St., Indianapolis, Ind., units for 30 and 50 gal. drums can also be obtained.

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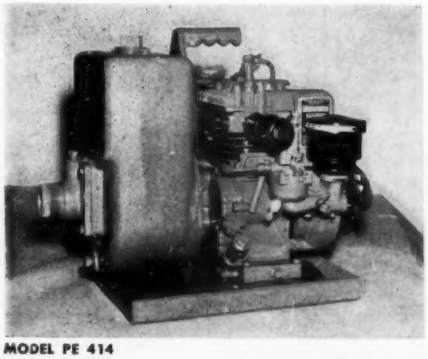

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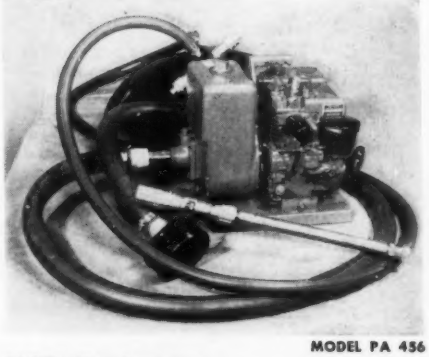
Pump up to 100 gpm; open type; self-cleaning impeller will pump semi-solids up to ⅜" diameter or sediment-laden liquids. Self-lubricating seal, 3 qt. priming tank has 250 psi pressure limit. Designed for use with any size solution tank.

Model PE 414 (left) Shipping weight: 65 lbs.

Model PA 456 (right) fully equipped, ready to use with 10' suction hose, suction strainer, 10' by-pass hose to keep solution mixed. Two 100' lengths ½" I.D. treating hose. Adjustable treating gun and much more. Shipping weight: 160 lbs.



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What's NEWS In The Industry

Gillespie Named NPCA Technical Assistant

Billy B. Gillespie, entomology graduate of Purdue University and former technical director-service supervisor of Smithereen Exterminating Co., has been named technical assistant of the National Pest Control Association.

The 27-year old Chicagoan was hired to assist technical director, Dr. Philip J. Spear with the increasing technical problems that have stemmed from insect resistance, new chemicals and equipment, new procedures, and a growing membership.

According to the announcement made by association executive secretary, Dr. Ralph E. Heal, Gillespie was interviewed by five members of the NPCA Executive Board before he was chosen from the field of candidates for the job.

Gillespie will help write technical releases, work with various NPCA committees on technical problems, assist in convention and conference programs, and keep broadly and currently informed on technical developments of interest to the industry.

Before receiving a masters degree in entomology at Purdue, where he specialized in household pests and termiticides, Gillespie obtained his BA degree in agricultural entomology at Texas A & M College. He served two summers as a field technician for the U.S. Department of Agriculture's Bureau of Entomology and Plant Quarantine in Texas, one year as field technician for the Texas Agricultural Experiment Station and two years as a military entomologist for the U.S. Army. He spent four years as technical director for six branch offices of Smithereen Exterminating Co., Chicago, Ill.

"It has always been my desire to be in, or allied to, a field or organization which has the excitement of production and the prestige of a growing technical operation. My new assignment with the NPCA offers this challenge," Gillespie said upon learning of his new appointment. He began work at the NPCA's Elizabeth, N. J. headquarters on December 12.

Billy B. Gillespie, NPCA technical assistant.

Midwest PCOs Meet in March

A combination business administration-technical program is being prepared for the Central Midwest Pest Control Conference to be held March 9 and 10 at the Town House, Kansas City, Kans., in cooperation with the National Pest Control Association.

Program Chairman Harold L. Coleman and Dr. Harlan R. Shuyler, local chairman, said they are lining up experts in both the technical and business ends of the industry to speak at the meeting.

Reynolds is Conn. PCA Pres.

Members of the Connecticut Pest Control Association elected new officers for 1961 at a recent meeting. They are: Joshua Reynolds, A-One System Pest Control Service, New Britain, president; Richard H. Ledwith, Berg Exterminating Co., West Hartford, vice-president; and Robert Nevers, Abbot Pest Control, New Haven, secretary-treasurer.

VPI Studies Roach Genetics, Mutations, PCO Meet Told

Studies of genetic mechanisms involved in the inheritance by roaches of resistance to chemicals, and a probe into certain mutations which have occurred spontaneously in German roaches, are being conducted at Virginia Polytechnic Institute, Blacksburg. This was announced to delegates who attended the VPI three day PCO short course, Nov. 9-11.

Dr. D. G. Cochran, associate professor of entomology, Virginia Agricultural Experiment Station, VPI, told attendees that genetic changes and mutations must be studied thoroughly if the problem of resistance is ever to be understood, "let alone solved." He said he could not give details of the tests until further progress has been made. These investigations are in addition to those NPCA sponsored tests to overcome roach resistance being conducted by Dr. James McD Grayson, VPI head entomologist.

More than 75 members of the pest control industry attended the course conducted by Dr. J. O. Rowell, extension entomologist of the institute.

Dr. Philip J. Spear, NPCA technical director, opened the course with a discussion on "The NPCA's ARP Up to Date." Dr. H. S. Mosby, professor of wildlife management at VPI, who spoke on "Control of Objectionable Birds," Dr. R. J. Kowal, chief of the U.S. Forest Insect Research Division, Asheville, N. C., who explained "Current Research in Termite Control in the U.S. Forest Serv-

Up-to-date research reports were delivered to these PCOs who attended VPI's Short Course.

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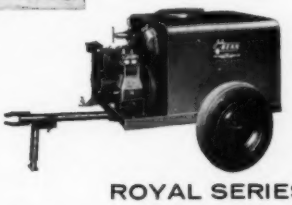

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ice;" and Dr. F. N. Atkins, associate professor of architecture at VPI with a talk on "Glossary of Terms Relative to Termite Control," participated in the first day's program.

Other speakers were Dr. Cochran on the cockroach test results; Dr. E. C. Turner, associate professor of entomology, Virginia Agriculture Experiment Station, VPI., who informed the group about "The Face Fly, A New Problem in This Area;" and Dr. John Kilpatrick, of the U.S. Public Health Service, Savannah, Ga., who reviewed "New Developments in Resistance" and "Control Studies of the U.S. Public Health Service."

Dr. Kowal concluded the program with a discussion on "New Developments in Structural Wood Pest Control Problems."

Ten-year attendance certificates were presented to five delegates to the course at the annual banquet.

The '61 short course is scheduled for November 7-9.

S. C. PCA Re-Elects Gressette

Furman Reeves Gressette, Gressette Pest Control Company, Orangeburg, S.C., has been re-elected president of the South Carolina Pest Control Association during a recent business meeting at Clemson College in Clemson.

Other officers elected were Bill Ford, Atlantic Pest Control, Charleston Heights, Charleston, vice-president, and L. S. Watford, Edisto Pest Control, Orangeburg, secretary-treasurer.

Board of directors chosen for the coming year consists of Max Askey, Pest Control Services, Inc., Columbia; John Clark, Jr., Wright Pest Control, Aiken; and E. L. Chapman, Miller Pest Control, Florence.

The association also appointed a committee to study the possibility of making a grant to Clemson College to stimulate more interest in entomology and pest control. Type and amount of the grant is to be determined by the committee.

In other business Charles Pomerantz, president of Bell Exterminating Co., New York City, was elected to an honorary membership in the SCPCA.

Notebook

TIPS AND IDEAS FROM THE FIELD

Four Commonplace Hazards

by JAMES V. SHOAF
Central Exterminating Co., Inc.
Cleveland, Ohio

Justifiably, many of us are particularly cautious in avoiding contamination of foodstuffs with our pesticides, a very important part of an overall job-safety program.

But, there are commonplace safety hazards that are around us every day in our routine service work. Let's consider four we sometimes tend to forget:

Fire: Because we use more oil-based insecticides, spray or fog them around basements or kitchens where there is usually an open flame (in furnaces, hot water tanks, ranges), a real potential fire hazard exists. Careful inspection must be made of every such area we treat to be sure there are no open flames.

Electric shock: These can easily be caused when our water-based insecticides come in contact with electric motors, switch boxes, receptacles, etc. Extra care needs to be taken to keep such sprays away from these sources of shocks.

Dermal, oral, and respiratory poisoning: Many of our insecticides, insecticide concentrates, and rodenticides are readily absorbed through the skin. Care must be taken to prevent excessive skin contact. Wear gloves and protective uniforms.

Oral poisoning is usually the result of poison being taken through the mouth because hands have been contaminated. Wash your hands frequently.

Respiratory poisoning is caused by inhalation of noxious and toxic vapors. Wear the appropriate respirator whenever there's a chance for inhalation of pesticides.

Related Accidents: These are usually caused because excessive amounts of insecticide are used, or from leaking sprayers and nozzles, or just plain carelessness. Spilled chemicals on floors and steps should be wiped up immediately to prevent serious falls.

There are many other specific danger areas in our work, but most can be avoided if we use common sense and work the safe way!

Our Customers Are Our Best Salesmen!

better performance means better business for you, too!

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Dear Mr. Simpson:

We have used your bulk pellets and Throw-Pacs with considerable success.

In fact, we stored the bulk pellets in an outside building on an acre of land just one mile East of the Capitol in Charleston, West Virginia, and the rats cut through the bags on the first night of storage and ate a large quantity of the pellets. Several days later, we picked up 47 rats on our premises.

Believe we have had the best results with your material of any we have used over a period of the past twenty-seven years.

Cordially yours,

Eugene E. Workman
Manager
TOPS-ALL TERMITE CONTROL
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Dear Mr. Simpson:

We have been most pleased with the results received on using your Bulk pellets and your Throw-pacs.

Our problem of acceptance on the part of the Rodents seems to have been completely eliminated. As you can see from our repeat orders, we plan on providing all of our Service Personnel with your product.

Sincerely,

Lester A. Meis
Engineer-Director
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Calendar

Insect and Rodent Control Training Course No. 241. Communicable Disease Center, Emory University, Atlanta, Ga., Jan. 9-20.

New Jersey PCO Short Course. Entomology Bldg., The Rutgers U., New Brunswick. Jan. 16, 17, 9 a.m.

Southern PCO Conference, Heidelberg Hotel, Jackson, Miss., Jan. 16-18

North Carolina PCO Short Course. North Carolina State College Union Building, Raleigh. Jan. 17-19.

Second Arizona Pest Control Operators School. University of Arizona, Tucson. Jan. 20, 21.

Pest Control Assn. of South Florida. Monthly Meeting. Lindsey Hopkins Vocational School, 1410 N.E. 2nd, Miami, Jan. 23, 8 p.m.

Indiana Pest Control Assn. Annual Meeting. Room 218, Memorial Center, Purdue University, Lafayette. Jan. 23, 7:30 p.m.

Entomological Society of America, Southeastern Division. Annual Meeting. Admiral Semmes Hotel, Mobile, Ala., Jan. 23-25.

Purdue University's 25th Annual PCO Conference. Purdue University, Lafayette, Ind., Jan. 23-27.

Hawaiian Pest Control Assn. Monthly Meeting. Evergreen Restaurant, Honolulu. Jan. 24, 7 p.m.

Eastern PCO Conference. University of Massachusetts, Amherst, Jan. 25-27.

American Mosquito Control Assn.-California Mosquito Control Assn. Joint Meeting. Disneyland Hotel, Anaheim, Calif., Jan. 31-Feb. 2, 1961.

Northeastern Mosquito Control Assn. Annual Meeting. Massachusetts U. Field Station, Waltham, Feb. 15.

Joint Meeting of Virginia and Washington Pest Control Assns. Place to be announced. Feb. 17, 18.

Pest Control Operators of California. Monthly Meeting. Jack Tar Hotel, San Francisco, Feb. 23-25.

Pacific Northwest PCO Conference, Imperial Hotel, Portland, Ore., March 5-8.

Central Midwest PCO Conference, Town House Hotel, Kansas City, Kans., March 9, 10.

Alabama PCO Licensing Exam., Agricultural Bldg., State Fair Grounds, Birmingham; Courthouse, Decatur; Courthouse, Gadsden; State Vocational School, 925 Fulton Rd., Mobile; 882 State Office Bldg., Montgomery. March 21.

New Jersey Mosquito Extermination Assn. Annual Meeting. Hotel Chalfonte-Haddon Hall. March 29-31.

Rhodes to Expand PC Supplies

Roland Rhodes has been appointed general manager of Pest Control Supplies, 3622 State Ave., Kansas City, Kans., which handles a general line of equipment and supplies for the pest control industry. With the appointment of Rhodes, the company plans to expand its sphere of sales and service from the Missouri and Kansas area to the entire Midwest.

Rhodes was formerly associated with Cook Chemical Co.

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Delegates Co-Sponsor Licensing Bill at Texas PCA Convention

Another move to block the use of pest control chemicals by unskilled persons was made by 145 delegates to the Texas Pest Control Association Convention held Dec. 1-3 in San Antonio.

By unanimous vote the association approved co-sponsorship with the Texas Health Department of a re-written bill to make licensing of persons handling pesticides mandatory. It will be submitted to the state legislature when it convenes this month.

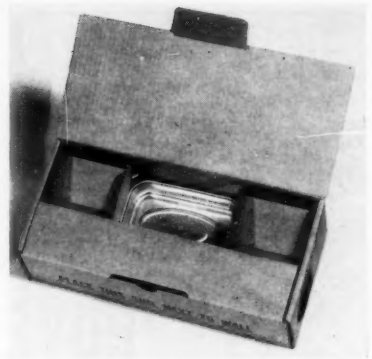
States surrounding Texas have laws governing use of pest control chemicals and officials of the Texas PCA and Health Department feel one is needed to block careless novices from working in their state. Some Texas cities have local ordinances requiring PCOs to be licensed, but a state-wide "clamp down" is being sought.

Delegates to the convention also attended some five technical sessions where they heard experts recommend how to control such pests as lawn and ornamental insects, rats and mice. Valuable tips on fumigation, equipment, new insecticides were also given.

Dr. Ralph E. Heal, executive secretary of the National Pest Control Association, gave an up-to-date report on the response and acceptance of the NPCA Termite Insurance Program, plus the progress of NPCA-sponsored research at leading colleges and universities.

"The Pest Control Industry — Predictions of Things to Come" was the topic of a talk by Herman Fellton, Getz Exterminators, Atlanta, Ga. He told the group that precautions observed today in the use of insecticides will have to be intensified in the future, despite new progress in chemicals.

The formal session of the first day was concluded with a report on "Insect Pests of Ornamentals and Lawns" and how to control them, by Connie F. Garner, assistant extension entomologist of Texas A & M College.



A rust-resistant liquid poison tray is included in this new "Protect-O-Bait" rat and mouse feeder developed by Arwell, Inc. It can be used for dry bait only or, by removing two perforated sections, will hold liquid poisons. Lid of this cardboard bait station has a space on which a PCO can advertise his name. For price and details on Protect-O-Bait feeder write Arwell, Waukegan, Illinois.

New officers and board members of the Ohio Pest Control Association are (standing left to right) Luther Amrine, Bernard Berger, Herman Flanagan, W. J. Morris, and E. A. Villiers. Seated left to right are James King, James Shoaf, James Benschoter, John Kuhl, and A. A. Johnson.

Speakers during the second general session included Dr. R. H. Roberts, U.S. Department of Agriculture Experiment Station, Kerrville, who discussed "Insecticidal Residues and Public Health Problems;" Clayton Wright, C. Wright Associates, Dallas, on new insecticides for pest control; and Milton Caroline, district agent of the U.S. Fish & Wildlife Service, San Antonio, who gave some valuable tips on rodent control, traps, and bait preparation. He was assisted by C. L. Cadieux and Calvin W. Johnson of the F&WLS.

Materials, equipment, know-how, and safety of fumigation were explained by J. S. Cook, of the H. T. McGill Company, Houston. A rundown of pesticide and toxicity hazards to household pets was given by Dr. Rudolph Radcliff of the Kerrville USDA Experiment Station. Panel discussions on equipment and special control methods were spotted throughout the convention.

At its business meeting, the association elected Vernon Bryant, Laredo Pest Control Co., Laredo, president for the 1961 term. Carl Abel, Abel Exterminating Co., Fort Worth, was made vice president; and William Cohen, Pest Fog., Inc., Corpus Christi, secretary-treasurer.

Delegates chose McAllen, Texas as the site for their 1961 convention and Abilene in 1962.

Termite Resistance Possible, Butts Tells Ohio PCOs

(*from page 44*)

sociation members elected James V. Benschoter, Ben-E-Lene Exterminators, Toledo, president for 1961. James Shoaf, Central Exterminating Co., Cleveland, was chosen vice president, and John J. Kuhl, Tornado Manufacturing Co., Columbus, was re-elected secretary-treasurer.

The 1961 Directors are Luther Amrine, Extermital Chemicals, Inc., Dayton; W. J. Morris, Modern Pest Control, Akron; Herman Flanagan, State Termite Co., Canton; E. A. Villiers, Franklin Exterminating Systems, Inc., Columbus; Bernard G. Berger, Able Pest Control Co., Springfield; A. A. Johnson, Ace Termite, Inc., Portsmouth, and past president James J. King.

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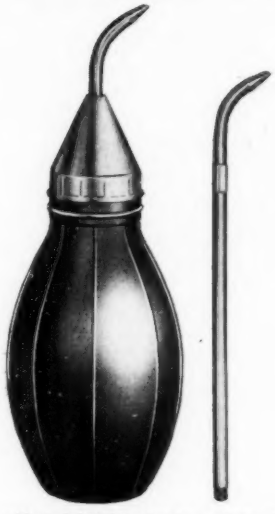

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Infestation Report

Contains pertinent portions of the Department of Agriculture's Cooperative Economic Insect Report, material from university entomology departments and reports from readers. PCOs noticing infestations in their own areas are urged to communicate with *Pest Control* so their information may be added to this infestation report.

FIRE ANT
(*Solenopsis geminata*)
Texas: Mounds very common along roadsides and in fields in Brazos, Burleson, Lee, and Washington Counties. As many as three mounds per square yard in some areas.

IMPORTED FIRE ANT
(*Solenopsis saevissima richteri*)
North Carolina: Eleven properties found infested in Brunswick County.

LARGER YELLOW ANT
(*Lasius interjectus*)
Maryland: Winged forms noted around homes in Baltimore, Caroline, and Prince George Counties.

POWDER POST BEETLE
(*Trogoxylon prostomoides*)
California: Heavy infestation in Japanese bamboo drapes in a home in Richmond, Contra Costa County.

BOXELDER BUG
(*Leptocoris trivittatus*)
Kansas: Entering homes in Finney County area; numbers extremely large. **Virginia:** Adults and nymphs common in several areas of Roanoke County and common in area of Trazewell County. **Nebraska:** A nuisance in homes in one-third of the state. **South Dakota:** Very numerous in eastern area.

PUSS CATERPILLAR
(*Megalopyge opercularis*)
South Carolina: As many complaints of stings to individuals from this species reported this season as have been reported in the last 25 years combined.

COCKROACHES
New Mexico: *Blatta orientalis* and *Blattella germancia* have become a serious nuisance in homes in Dona Ana and Bernalillo Counties. **Utah:** *Supella supellectilium* infesting a home and two apartments in Logan, Cache County. **Virginia:** *S. supellectilium* infesting storage building at naval supply center, Norfolk. This is a first known infestation at this location.

BLOODSUCKING CONENOSE
(*Triatoma protracta*)
New Mexico: Members of a number of families bitten in Virden Valley. Several people treated by physicians.

EARWIGS
California: Light infestation of *Labidura riparia* in a kitchen of a home in Indio, Riverside County. **Pennsylvania:** *Forficula auricularia* collected in Lackawanna County.

FACE FLY
(*Musca autumnalis*)
Indiana: Warm winter periods extended problem in homes in localized areas of Tippecanoe and Warren Counties.

HOUSE FLY
(*Musca domestica*)
Oklahoma: Continue to be a nuisance in many areas of the state as adults are entering buildings seeking shelter from cooler temperatures. **South Dakota:** Very numerous in east-central and southeast areas of the state.

MILLIPEDES
Oklahoma: Entering homes and causing concern to inhabitants in Woods County. **South Dakota:** Very numerous in basements and other sheltered areas in eastern area.

CLOVER MITE
(*Bryobia praetiosa*)
Nebraska: Invading homes in Lincoln area, Lancaster County. **Utah:** Moderate numbers entered some Provo and Logan homes.

BROWN-BANDED ROACH
(*Supella supellectilium*)
North Dakota: Home infestation reported in Towner County. **Utah:** Severe infestation in a home at Ogden, Weber County.

SUBTERRANEAN TERMITE
(*Reticulitermes* sp.)
Wyoming: Infesting timbers in a house in Cody, Park County.

BROWN DOG TICK
(*Rhipicephalus sanguineus*)
Oklahoma: Common in moderate numbers on dogs checked in Cleveland County. Causing concern to some pet owners in Payne County area.

RED TICK
(*Rhipicephalus evertsi*)
Florida: Discoveries of this livestock pest were made on zoo animals near Tampa. **New York:** Specimens were discovered from zoo animals in Hudson. Both infestations have been traced to a shipment of zebras from Kenya, Africa.

TICKS
California: Specimens of *Ixodes pacificus* taken from a man in Feather Falls, Butte County, and at Norwalk, Los Angeles County.

WASPS
(*Polistes* spp.)
Oklahoma: Causing considerable concern in many parts of the state.

The Winner!!! **SN. 7 SWINGFOG**

You Can't Beat this *MODERN PULSE JET PEST CONTROL UNIT*

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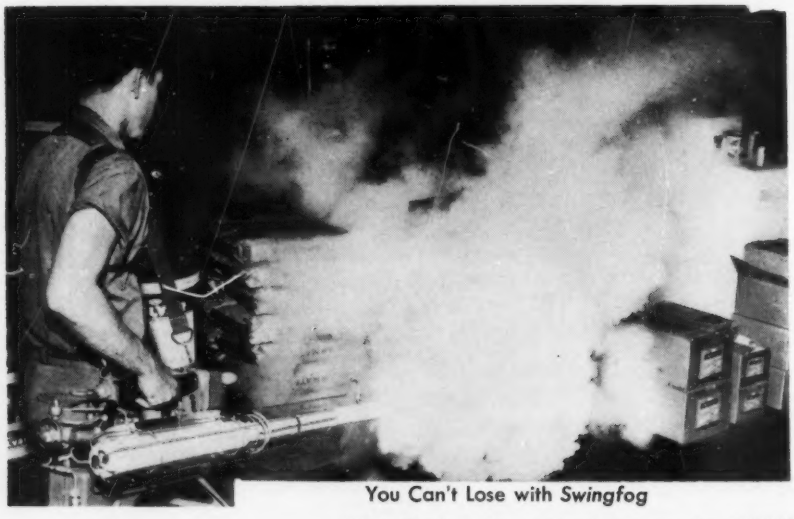

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- **Versatile. Ideal for outside and inside fogging.**
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- **Distributors throughout the USA.**

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MODERNIZE RODENT CONTROL WITH DE RATTER-MOUSER!

- Saves Bait
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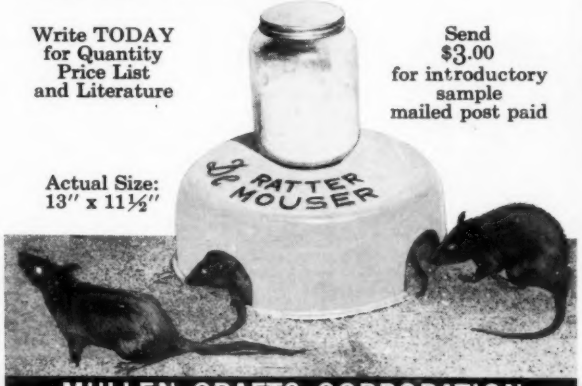
- Uses Both Dry and Wet Bait

The new DE RATTER-MOUSER makes continuous rat and mouse killing convenient, effective and economical—may be used in any location, under any weather conditions.

Write TODAY for Quantity Price List and Literature

Send $3.00 for introductory sample mailed post paid



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"NO ROOST"

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IT COSTS LESS!

. . . because you are buying from the country's leading producer of

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For more effective spraying . . . at lower chemical cost

Proper spray distribution, ample "reach" when you want it and dependable volume control contribute materially to effective coverage with minimum use of chemicals. These advantages are reliably yours with Spraying Systems equipment . . . proved through the years for quality design and better performance.

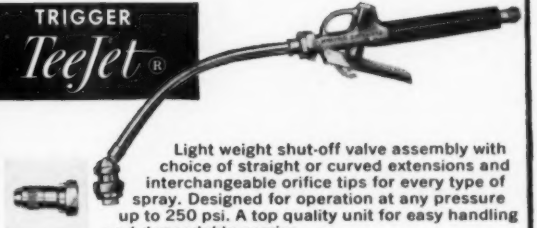
GunJet® No. 22-7676

for DRIP FREE SHUT-OFF

Shut-off needle extends through extension to valve seat placed immediately behind nozzle orifice. When you release the GunJet trigger, spray stops instantly; liquid in extension cannot drip out. No chemical waste. Supplied in 8", 18", 24" and 48" straight extensions. Complete choice of interchangeable orifice tips for flat, hollow cone, full cone and solid stream sprays in wide range of capacities. Note inlet location . . . only nozzle body, extension, cap and orifice tip touch chemicals . . . a design giving a quality, long wearing gun at minimum overall cost.

GUNJET SPRAY GUNS IN WIDE RANGE OF MODELS AND CAPACITIES FOR ALL PRESSURES UP TO 800 psi

TRIGGER TeeJet®



Light weight shut-off valve assembly with choice of straight or curved extensions and interchangeable orifice tips for every type of spray. Designed for operation at any pressure up to 250 psi. A top quality unit for easy handling and dependable service.

ADJUSTABLE TIPS—MulTeeJet Tip with four indexed positions for choice of flat and solid stream sprays. Adjustable ConeJet Tip for spray selection from solid stream to atomized cone.

Bottle Sprayers

Handy portable sprayers, equipped with quart plastic bottle, pneumatic atomizing nozzle and control valve. For spraying insecticides, sanitation chemicals and related uses.

Write for Bulletins 76, 87 and Data Sheet 7676

SPRAYING SYSTEMS CO.
3221 Randolph Street • Bellwood, Illinois

Classifieds

When answering ads where box number only is given, please address as follows: Box number, c/o Pest Control, 1900 Euclid Avenue, Cleveland 15, Ohio.

Rates: "Position Wanted" 5c per word, minimum $2.00. All other classifications, 10c per word, minimum $2.00. All classified ads must be received by Publisher the 10th of the month preceding publication date and be accompanied by cash or money order covering full payment.

POSITION WANTED

COLLEGE GRADUATE, age 35, married with 13 years experience in all phases of pest control, termite control, and fumigation. Desires technical position with large southwest or west coast company. Florida certified operator. Aptitude tested. Write Box 565, Pest Control magazine.

HELP WANTED

WARM CLIMATE, Resort area, experienced PCO, approximately 45-60 years to carry on my business while I am on U.N. assignment. Opportunity for part-time permanent affiliation later, if desired. Termite and fumigation experience not necessary. Replies confidential. Box 566, Pest Control magazine.

COLLEGE GRADUATE, Entomologist with experience in pest control field desired, however, not necessary for general operation manager. Good future for right person. Write resume in detail to Box 555, Pest Control magazine. All replies held strictly confidential.

NEED AT ONCE. Man experienced in using liquid HCN and methyl bromide for grain fumigation also custom rodent control. To organize and supervise new division for large chemical company doing business on a national basis. Send complete resume of background and experience. Interview will be arranged promptly. Box 570, Pest Control magazine.

FOR SALE

DYNA-FOG, SR. 2 years old, excellent condition. Reply to Box 567, Pest Control magazine.

WANTED TO BUY

PEST CONTROL business wanted in Ocean and Monmouth counties, New Jersey. Replies confidential. Best Exterminating Co., 9 Monmouth Park Pl., Oceanport, N.J.

PEST CONTROL business in New Jersey with good reputation. Replies confidential. Send details to Box 568, Pest Control magazine.

PEST CONTROL Business in South Carolina. Give details and price. Replies confidential. Box 553, Pest Control magazine.

MISCELLANEOUS

FLORIDA DISTRIBUTORS WANTED. Manufacturer of revolutionary new line of insecticidal fogging equipment desires representation in State of Florida. Write, stating lines carried and area covered. Box 569, Pest Control magazine.

Bird problems at Sportsman's Park in Cicero, Ill., are being tackled by Aegis Laboratories of Chicago with its new formula "No-Roost" bird repellent. Rafters of the race track's grandstands were recently treated with the compound to prevent pigeons and other birds from roosting above the seating area. Shown above is Aegis serviceman James Woods preparing to apply the repellent.

'61 Hudson Catalog in Color

A new full-color catalog of 1961 Hudson sprayers and dusters is now being distributed by the H. D. Hudson Manufacturing Co.

Over 140 items are listed and described by their manufacturer. To obtain a copy, write the company at 589 E. Illinois St., Chicago 11, Ill. Ask for Catalog No. 566.

— Advertisers —

SUPPLIERS ADVERTISING IN JANUARY

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FUMO-KILL *Two Way* **MONEY MAKER !**

The New Effective Fumigant That Will Kill

Mosquitoes, Flying Moths, Spiders, Silverfish, Flies, Wasps, and Exposed Waterbugs, Roaches, Bedbugs, and Ants

Follow instructions on can for best results

USE IT! SELL IT!

FUMO-KILL has the following advantages:

EASY TO USE: Requires no Special Equipment.

ECONOMICAL TO USE: Two ounces fumigates up to 6,000 cubic feet.

FUMO-KILL is truly the modern method of insect extermination. Light match to contents of can, will produce fumes — NO FLAME. Non-hazardous. This amazing FUMO-KILL insecticide has been tested, and found effective against most types of household pests.

This amazing FUMO-KILL insecticide is by all qualifications a leader in its field.

For complete information write or phone today

Available Only From **MAR-MEL** *Products, Inc.*

Phone Van Buren 6-2060—61

753 South Kedzie Ave. Chicago 12, Illinois

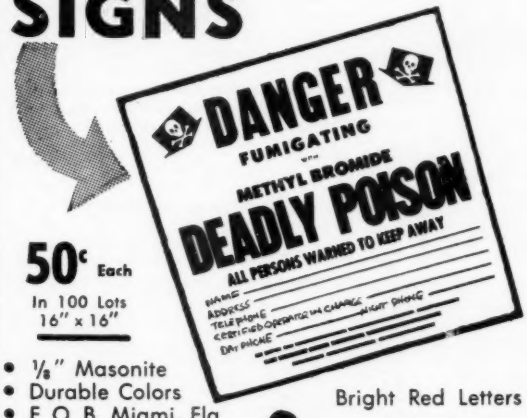
FUMO-KILL can be obtained in 2 oz. (enough for up to 6,000 cubic feet)—4 oz. and 1-lb. cans.

Cost of 12—2-oz. Cans . . . . $ 7.50 per doz.
Cost of 12—4-oz. Cans . . . . 13.50 per doz.
Bulk . . . . . 4.50 per lb.

Delivery Charges Prepaid

"A Must for every Job"

SIGNS



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Let Us Put Our 46 Years' Experience to Work for You Specializing in

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Easy to Install RID-A-BIRD PERCH
ELIMINATES BIRD PROBLEMS

Unsightly, unsanitary and costly conditions caused by pest birds can now be safely solved by the unique Rid-A-Bird perch. Easily installed (see photo) and refilled only twice a year, the perch insures permanent removal of sparrows, starlings and pigeons. Successful installations include factories, aircraft hangars, grain elevators, loading docks, warehouses, farm buildings, garages, stores and buildings.

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Muscatine, Iowa

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ADDRESS _____

CITY _____ STATE _____

Pestales

A semester in Germany **is what Miss Jane Schendel is spending as an American Field Service exchange student at Elsa-Brandstrom-Schule in Hanover. She is the 17-year old daughter of Bob Schendel, Schendel Pest Control, Topeka, Kans. Her dad is anxiously awaiting her return to the U.S. next month. Miss Schendel was one of three high school students from Kansas selected to participate in the exchange program.**

* * *

Rock 'n roll repellent. Officials of an air base in England have discovered a sure way to chase birds from landing strips. When a flock begins to congregate, the observation tower director plays a rock 'n roll recording of Elvis Presley over the amplifying system. It reportedly takes only a few bars of Presley music to drive the flock away. This doesn't work with any other singer, the officials claim.

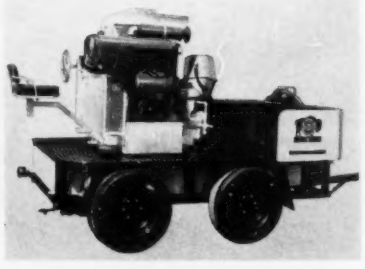
* * *

Betwixt and between. **Walter O. Blank, president of Abalene Pest Control Service, Inc., Albany, N. Y., falls into a quandry each year around NPCA Convention time. His birthday comes right in the middle of each convention week and he is torn between attending the meet or spending his birthday at home with his family. The latter choice usually wins out, so Walter will probably be absent from conventions until they are held in New York state or near his winter home in St. Petersburg, Fla.**

IS THERE A KILLER IN YOUR COMMUNITY?

DUTCH ELM DISEASE IS A KILLER AND CAN ROB YOUR COMMUNITY OF ITS BEAUTY. THE NEW FST-2 BUFFALO TURBINE SHADE TREE SPRAYER CAN PROTECT YOU AGAINST THIS MENACE.

- Shade Trees
- Mosquito Control
- Fire Retardants
- Seeding



- Soil Stabilization
- Broadcasting
- Fly Control
- Weed Control

LOOK AT THESE FEATURES...

Trailer-Tandem axle — large deck area — 200 gallon removable stainless steel tank and 15″ filler screen — piston pump, 2 cylinder, 10 GPM, 400 PSI — Jet tank filler, 2″ quick coupling suction hose, 42 GPM — mechanical agitation —large dust bins — hydraulic spray gun and hose.

We'll be looking forward to seeing you at the American Mosquito Control Association Meeting January 30-February 2, 1961 at Disneyland, California.

We'll be at Booth 14.

Several valuable territories open.
Dealers write for details.

BUFFALO TURBINE
Agricultural Equipment Co., Inc.
70 Industrial Street
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SPRAYER TURBULENT AIR DUSTER BUFFALO TURBINE

Traveling agent. **David A. Weisburger, principal owner of the B. & D. A. Weisburger insurance firm, and a pioneer writer of coverage for PCOs, tells us he is also insurance broker for *Newsweek* magazine, a job which takes him to far corners of the World. Dave has just returned from a trip to the Orient where he visited *Newsweek* offices and is looking forward to a trip to a new plant in Australia. His firm also had a nice write-up in the Insurance Company of North America publication. Happy travels, Dave.**

* * *

From Guarantee to North Jersey. **Harry J. Heale, a district manager for Guarantee Exterminating Co. in New Jersey for 31 years, has joined the North Jersey Termite Co. Inc., Bloomfield, as director of technical and promotional work.**

* * *

Life member. **Luther M. Church, Sr., lifelong member of the NPCA who has served it in many capacities, was awarded a life membership in the association by its board of directors. Luther has retired from his Getem Manufacturing Co. pest control business in Norfolk, Va., after 25 years. His son, Luther M., Jr. is now running the business.**

* * *

Champ! **Simon Ratner, whose vocation is running Ratner Exterminating Co. in Washington, D. C., is now the proud holder of the New York and Massachusetts Senior Singles Table Tennis Championship. Undoubtedly his dexterity comes from "keeping on the ball" in the keen East Coast competition this industry enjoys (?).**

* * *

Rats a la carte. Trainees at the Jungle Survival School of the Royal Air Force have a pretty rough curriculum, worst of which is their lunch hour. Meals during the seven-day course, designed to teach pilots how to survive if forced down in jungle territory, include hot roast rat with ferns and leaves as the main meat course. What does it taste like? Well, one graduate of the school has this to say, "Quite tasty. A bit strong perhaps, but a lot better than starving to death." Could it be that mice are served as hors d'oeuvres?

* * *

Sales champ. **Henry Brusse of Termitrol Engineers, Inc., an Arab Associates, Inc. franchise in Clearwater and St. Petersburg, Florida, has been shaking a lot of hands lately, accepting congratulations for winning two monthly sales contests conducted by the Arab parent firm in Indianapolis, Ind. His individual salesmanship also helped the Florida group win the national contest between all Arab's franchise holders. Nice work, Hank.**

* * *

Not to be outdone. **Charlie Rosenthal, onetime employee of an Atlanta based pest control firm, now has his own business in Tulsa, Okla., and advertises in the telephone book that he has the "World's Largest Pest Control Sign." Wonder how he could have come up with such a slogan?**

Fairfield Facts

CHEMICAL EDITION ★ ★ ★

SAFETY, SYNERGISM AND SALES APPEAL
THAT'S BUTOXIDE!!

The most extensive laboratory and field tests ever conducted on an insecticide by any company proved piperonyl butoxide's unique low order of toxicity which resulted in tolerances and official clearances not yet given to any other insecticide and its use with pyrethrins. Rats were fed piperonyl butoxide with all the food that they consumed from time of weaning through the normal lifespan and through three successive generations. Amount of chemical (right) is mixed with rat's weekly food ration contained in glass beaker.

TESTS PROVE BUTOXIDE'S LOW TOXICITY

Years of testing insecticide chemicals in Fairfield's research laboratories prove butoxide's unique low toxicity.

In addition, chronic feeding studies were conducted with rats, dogs, goats and monkeys. Cattle were sprayed twice daily throughout the season with butoxide and pyrethrins for four years. Not a trace of butoxide appeared in samples of the cattle's muscle, fat or milk. This resulted in clearance for use of butoxide and pyrethrins on dairy animals.

Laboratory tests made 14 years ago showed DDT's oral LD50 for rats is 200 mg/kg. At the same time the oral LD50 of undiluted piperonyl butoxide for rats was found to be approximately 8,750 mg/kg. Thus, towards rats, Fairfield's butoxide was only 1/43rd as toxic as DDT. By the time the toxicological studies were completed, it was found that the MLD50 for butoxide greatly exceeded the earlier reports. More recent work completed on chronic tests with piperonyl butoxide, completely satisfied the federal regulatory authority for their tolerances and clearances. At the present time all tolerances are based on chronic feeding tests.

For the formulator and manufacturer, Fairfield's butoxide, thus, plays an important role in producing insecticides with greater safety and salability... whether they are products for home, farm or industry. Consult your local Fairfield representative for further information or write today to Fairfield sales headquarters.

Fairfield Development Boosts Insecticide Performance

Butoxide, the best known and the most famous of all insecticide synergists, is a Fairfield research development. It gives insecticide formulators and manufacturers a more effective product...and it saves them money.

Piperonyl butoxide has the unique ability of tremendously increasing the insect killing power of certain chemicals.

For example, 0.125% by wt. of pyrethrins—though seldom used alone today—when applied against houseflies has a mortality of 43%. Cost is approximately $0.07 per pound.

But then add Fairfield's piperonyl butoxide and see what happens. A combination of 0.03% pyrethrins and 0.25% piperonyl butoxide applied against houseflies produces a striking 82% mortality. Cost of the butoxide and pyrethrins combination is $0.03 per pound. Quite a difference in both effectiveness and in price—*doubled performance at half the cost!*

The surging increase in effectiveness is the result of synergism, an action that takes place inside the insect's body. It produces the remarkable kill required in a popular, fast-selling insecticide.

There are other advantages too. Piperonyl butoxide is not only stable, but it acts as a stabilizer for certain other chemicals by reducing the effects of light, air and heat. It screens out deteriorating ultra-violet rays, thus, prevents deterioration of pyrethrins.

And because it is an acid acceptor, it retards decomposition and polymerization of pyrethrum. Since butoxide is also a solvent, it generally makes the addition of other solvents unnecessary —an important consideration when an odor-free product is desired.

And butoxide's synergizer-stabilizer role applies whether the chemical is pyrethrins, allethrin or rotenone.

What this all means is that butoxide puts greater effectiveness into a product and makes it last longer—on the shelf and after it has been applied by the user.

Putting Ideas to Work

FOOD MACHINERY AND CHEMICAL CORPORATION

Fairfield Chemicals

Sales Headquarters

441 LEXINGTON AVENUE, NEW YORK 17, N.Y.

Branches in principal cities. In Canada: Natural Products Corporation, Montreal and Toronto.

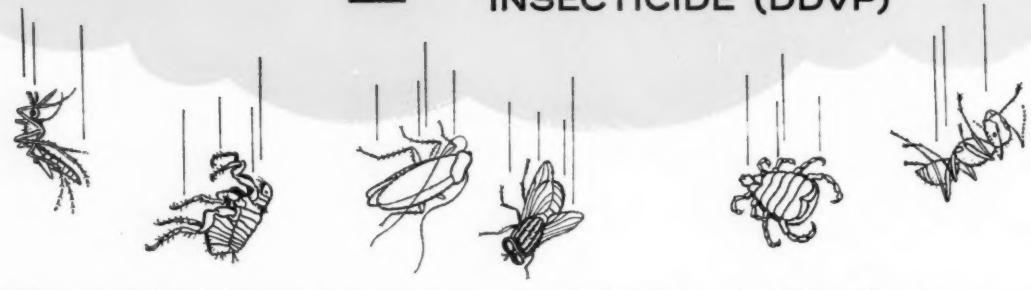
CONTROL ALMOST EVERY PUBLIC HEALTH PEST THAT CRAWLS OR FLIES...

even resistant species!

with NEW

Vapona*

INSECTICIDE (DDVP)



Now with new VAPONA insecticide you can put more power and more profit into your pest control operations. This revolutionary insecticide promises to be the hottest public health pesticide to come along in many years . . . even for resistant insects.

Vapona insecticide performs differently than conventional insecticides. Its lethal power is carried in vapor form. No longer can insects avoid insecticide contact in cracks, crevices and other hiding places. It gets the job done quickly, then disappears with ordinary ventilation.

Vapona insecticide's extremely low dosage means low cost. And it can be applied using ordinary pest control equipment and techniques.

Vapona insecticide controls houseflies, cockroaches, mosquitoes, fleas, brown dog ticks, cigarette beetles, tobacco moths, Phorid flies, face flies, spiders, ants and a host of other pests. It can be used in: horse stables, animal buildings, milk sheds, outdoor areas, tobacco warehouses, food processing plants, households, restaurants, theaters, and many other areas.

Put new insecticide power to work in your pest control operation with powerful, dependable Vapona insecticide. To get the full story on Vapona insecticide and its many applications, contact the district office nearest you.

*SHELL TRADEMARK

SHELL CHEMICAL COMPANY

AGRICULTURAL CHEMICALS DIVISION

110 West 51 Street, New York 20, New York

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